How are Outdoor Educators in Minnesota Using Technological Devices to Deliver Curriculum?

THESIS

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by

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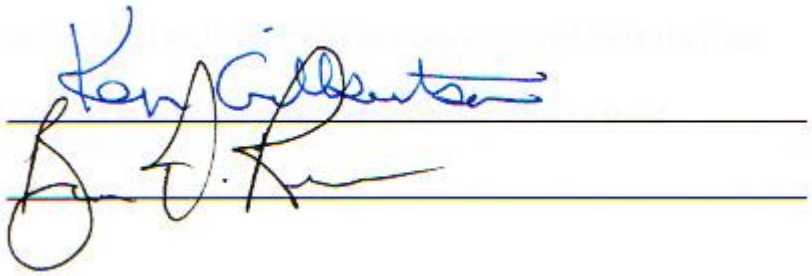

ABSTRACT

There is a philosophical tension between outdoor education and technology (Neill, 2010). Outdoor educators often encourage students to leave their technological devices behind and experience the natural world without cell phones, iPods or any other electronics. However, these same 'devices of distraction' can also be used as electronic field guides, portable data collection devices for use in the field, and in various other ways to help deliver outdoor education curriculum.

At a time when 93% of Americans under the age of 29 use mobile phones and are online every day (Lenhart, Purchell, Smith, & Zickuhr, 2010), outdoor educators will be more effective helping a plugged-in generation connect with nature if they understand what technological devices are being used by learners, and what devices are being used by other outdoor educators.

This study describes how outdoor educators working at Minnesota nature centers, aquaria, zoos and parks are using technology while teaching outdoors. 105 outdoor educators in Minnesota responded to an online survey which asked questions about how they use technological devices to deliver curriculum while outside. 54% of respondents (n=57) work in either a nature center or in a K-12 school. 64% (n=67) of respondents were between the ages of 22 and 44. Respondents felt that they do not use as much technology as their colleagues, although in reporting the variety of devices they did use, this does not actually appear to be the case.

The outdoor educator who is aware of what technological devices exist and how they can be used to deliver educational content will be in a better position to decide how to most effectively deliver curriculum in their outdoor classroom.

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CHAPTER ONE

INTRODUCTION

The purpose of this study is to determine how outdoor and environmental educators are using technological devices to help deliver educational curriculum in outdoor settings, and to determine why they are or are not using them. As people become increasingly accustomed to using technological devices in their day-to-day lives, nature centers may want to capitalize on this familiarity by incorporating these types of devices into their educational offerings. The findings of this research can help understand the potential benefits of, and concerns about using technology as a method to deliver nature-based learning.

Importance of Study

The current literature includes many examples describing how electronic devices are being used for curriculum delivery in outdoor and environmental education. However, as yet there is no study that describes how outdoor educators themselves are responding to these emerging new technologies, and specifically, which devices outdoor educators have begun to integrate into their teaching. Over the past few decades, there has been an increase in the adoption of new technological devices in many different fields, including smartboards in traditional classrooms, global positioning system (GPS) navigation in trucking and shipping, or the use of iPhones, Blackberries or mobile phones for business applications. As other fields and industries continue to adopt new technologies, outdoor educators and nature centers should be aware of what tools exist, so they can make deliberate and informed choices about how or whether to integrate technological tools into their curriculum.

Throughout the course of history humans have learned, as a matter of survival, how to recognize the difference between healthy plants and toxic ones as they walked through the woods. They learned which insects were good for crops, why bulbs should be planted in the fall, which different species of birds were common during which season, and which types of trees produced the sweetest syrup. Knowing how to bank a fire, build a canoe, or how to catch and prepare fish were skills that almost every child learned as a natural part of the process of growing up in the world. These connections to the natural world and to the land were passed down through the generations, by direct experience from parents, grandparents, friends and neighbors.

This direct experience of nature is diminishing. Louv describes a 'criminalization of nature play,' where homeowner associations and neighborhood ordinances are limiting, and sometimes outright barring, access to nature (Louv, 2005). Because of this, an increasing number of people today are becoming accustomed to experiencing the natural world via a mediated experience. For example, in 2007, the popular television series BBC's *Planet Earth* "received the highest audience appreciation score of any British programme on TV" (*BBC 2007 Annual Report*, 2007, p. 3). Similarly, activities such as 'telegardening' and 'telehunting' are being developed, which allow people to engage in traditionally outdoor activities (gardening and hunting) via a web browser, using a robotic, remote-controlled appendage, from the comfort of their home (Kahn, Jr. et al., 2008). These highly scripted nature experiences can be effective at presenting specific aspects of the natural world, but they are not able to adapt their content or delivery style to suit every viewer. They also lack the critical component of direct experience, a component essential to knowledge and understanding of the natural world: "Learning involves transactions between the person and the environment" (Kolb, 1984, p. 34). Someone watching *Nature* on PBS does not expect the show to correlate a particular episode's subject matter to phenological changes

that are occurring outside their window, at the moment someone views the program. One knows that the BBC's *Planet Earth* will take a very specific journey and that no unexpected 'teachable moments' relevant to a specific audience will arise. When the easiest connections to nature a person can make occur in such proscribed fashions, often about regions or subjects that are physically distant from the viewer, it is not surprising that each successive generation would tend to have a weaker connection to the lore of the natural world. Therefore, it is important to know what tools help us to deepen our direct experience with nature, and discover if there are technological tools that can augment rather than hinder an enhanced connection to the natural world.

Practitioners in the field of outdoor education work to counteract this trend by providing direct, experiential education opportunities for people interested in learning more about the outdoors (Gilbertson, Bates, McLaughlin, & Ewert, 2006). Outdoor educators who use technological devices to augment their lessons may have an advantage over outdoor educators who do not, since more people are using personal technological devices than ever before. According to a 2010 survey by the Pew Center, over 70% of Americans under the age of 64 spends at least some part of each day online (Lenhart et al., 2010, p. 5). Additionally, an increasing number of these people are accessing the Internet through the use of mobile technologies. In 2002, 19% of the global population had a mobile phone subscription. By the end of 2008, that number had increased to 50% (Teltscher, Magpantay, Gray, Olaya, & Vellejo, 2009). A change of this speed and magnitude clearly indicates that the shift toward mobile phone usage is increasing worldwide. Its increasing ubiquity has made it possible for the mobile phone to become a platform for delivering education.

With people worldwide becoming comfortable using technological devices on a day-to-day basis, how they use their device becomes a matter of importance. It is important to understand an individual's technological environment, in order to understand "how that person uses the Internet, connects with others and accesses information" (Lenhart et al., 2010, p. 9). If more people than ever are using mobile technological devices as a way to interact with the world, perhaps outdoor educators should consider using teaching methodologies that incorporate these devices. At this point, the maxim 'You should meet learners where they are, and not where you wish they were' seems appropriate. If the general public is increasingly comfortable using technological devices, then perhaps outdoor educators should begin to incorporate them into their teaching methodologies.

In an effort to encourage students to leave behind the distractions of mobile phones, iPods and other small-screen devices, outdoor educators can often be heard exhorting their students to 'leave the modern world behind,' before they venture outside for a lesson. Such comments may create the impression that outdoor educators lag behind more traditional educators in the adoption of electronic technologies for educational purposes. Whether or not this is true, and recognizing that the march of technological progress will likely continue unabated, outdoor and environmental educators will certainly be more effective if they are at least conversant in the language of this new, digital age.

Outdoor educators are teaching professionals whose life work is spent outdoors, using their knowledge of the natural world to teach skills and concepts that are increasingly unfamiliar to a populace that spends more and more time indoors. Skills such as bird identification, navigating with a map and compass and canoeing are made more familiar and accessible by outdoor educators. There are a number of methods and tools to deliver pedagogical content, including

lectures, games, storytelling, and field guides. Technology as a vehicle for content delivery seems to be the one method that outdoor educators have been slow to adopt.

This is not to suggest that outdoor education is a field which should only be taught using some electronic interface. “That which can best be taught inside the schoolrooms should there be taught, and that which can best be learned through experience dealing directly with native materials and life situations outside the school should there be learned.” (Sharp, 1943, p. 363) When Sharp wrote these words, he probably did not expect that one day, teachers would have the ability to bring the equivalent of the town library outside the classroom and into the outdoors.

Today, cell phones, iPods and tablet computers have the ability to go almost anywhere and deliver more content than traditional, book-format field guides, including the most up-to-date information, photos or video. With electronic devices becoming increasingly commonplace, it would be surprising if outdoor educators did not choose to occasionally start integrating these devices into their outdoor teaching curriculum.

Problem Statement

It is not known to what extent outdoor educators in Minnesota are using electronic technology as a teaching aid, nor their level of comfort in using these technological devices.

Objective

The objective of this project is to survey environmental educators in Minnesota to determine which, if any, technological devices they are currently using for teaching while outdoors.

Definitions of Terms

Digital Immigrant: A person who was born prior to the development of electronic technologies became commonplace, but one who has willingly adopted many aspects of these technologies (M. Prensky, 2001).

Digital Native: A person who was born at a period in time where their entire lives have included access to and interaction with digital media. These are people who are "…"native speakers" of the digital language of computers, video games and the Internet" (Prensky, 2001, p. 1).

Environmental Educator: Environmental educators are those who "help to increase public awareness and knowledge about environmental issues or problems… (to) provide the public with the necessary skills to make informed decisions and take responsible action" (Environmental Protection Agency, 2009)

Environmental Learning Center: A facility which provides environmental themed education, often in an outdoor setting, typically using experiential learning.

Experiential Learning: Learning by doing, or "a process through which a learner constructs knowledge, skill and value from direct experience" (Itin, 1999, p. 91).

Outdoor Education: Outdoor education is primarily experiential education, where the learner is directly engaged in the activity being learned (Gilbertson et al., 2006, p. 6), and that activity will typically take place outside.

Smartphone: A mobile telephone with enhanced computing capabilities; typically includes camera, GPS, document creation and data manipulation.

Tablet Computer: A fully functioning computer, similar to a laptop computer, but without keyboard. May have connection to the Internet.

Technology: The word 'technology' comes directly from the Greek word technologia, and combines two ideas: *téchnēb,* (a skill or a craft) and *logía* (a branch of knowledge or discipline) ("technology," 2010). Historically, technology has meant applying practical knowledge to a particular skill.

An operational definition of technology is also needed. For this paper, 'technology' is generally used to describe electronic devices, meaning devices which are typically portable, are battery powered, have a screen upon which to view words or images, usually have a speaker from which to hear sounds, and have some degree of connectivity to the Internet for additional data and information. This connectivity will typically occur via a cellular data network, Wi-Fi, Bluetooth, or a direct-cable connection. Examples of these devices include, but are not limited to, mobile phones, personal digital assistants (PDAs), tablet computers, laptop computers, or GPS devices.

Limitations of Study

- The target population will be outdoor/environmental educators working in Minnesota, thus the results cannot be generalized beyond this population.

- The study will only be generalizable to the specific sample of educators being measured by the instrument.
- The instrument will include several examples of types of technological devices that may be in use, but it cannot provide every example of devices that may be in use.

Assumptions

- The findings of this study will be of interest to outdoor education professionals.
- Respondents will be using some form of technology for teaching to give the study validity.
- Technology can be a useful tool to help people learn while outdoors.
- Outdoor educators are interested in developing educational uses of technological devices.

CHAPTER TWO

LITERATURE REVIEW

Introduction

The main themes in the literature that are reviewed in this chapter will include an overview of existing research relevant to this topic, an exploration of the role of technology in society in general, an understanding of the concepts of digital natives and digital immigrants, a historical review of the changing ideas about educational technology, a review of how technology is being used in formal education and in outdoor education, and lastly, a summary of the advantages and disadvantages of using technological devices in education.

Existing Research Overview

A large body of research literature exists which explores the use of technology in education. When conducting multiple academic database searches, the phrases “educational technology” or “technology in education” return tens of thousands of articles. Similarly, there is a considerable amount of literature that is dedicated to investigating a number of different themes and ideas about outdoor education. Again, using the same academic database searches, the phrase “outdoor education” returns tens of thousands of articles.

However, relatively few studies combine the two ideas of ‘educational technology’ and ‘outdoor education’ in the same context. By combining these two search phrases, multiple academic database searches returned a few dozen results (and in some cases, no results). Among those results, few articles are actually relevant to the topic. For instance, one article focused on ‘safe use of technology for students’ in an Outdoor Education department at the University of Melbourne, in Australia – it was an article reminding students not to download inappropriate

material from the Internet. A number of results focus on GIS (Global Information Systems) and GPS (Global Positioning Systems), and reference their use by outdoor educators, but unfortunately none of those results were focused on pedagogical applications of those technologies.

Since the combination of these two primary phrase-ideas was not providing a strong return, the phrase “electronic field guide” was entered into the multiple academic database searches. This was more promising, with about 100 returns. This appeared to be a useful direction to pursue, as the articles themselves were interesting, but it was in their bibliographies where real progress in finding applicable resources was made. Following these few studies backwards leads to a valuable collection of resources could be developed to give this project a solid context from which to develop a thesis paper.

Of related interest, when conducting the same search of the phrase “electronic field guide” in the general, non-academic search engines Google and Bing, it was surprising to find over 50,000 possible matches. Although many of these matches are likely not relevant, one implication that might be drawn is that research may not keeping pace with popular culture. Phrased another way, society at large may be more ready to embrace the combining of outdoor education and educational technology than researchers or outdoor educators. This seems to indicate that research opportunities will continue to develop in this field for some time.

Another thing that quickly became evident during this search process is that the question of whether 'using technological devices to deliver curriculum is more effective than traditional methods of teaching' is an issue that has not been widely considered. Specifically, there does not appear to be research comparing these content delivery methods to determine which has greater efficacy. Also, there is a good deal of research that has been done investigating the use of

technology for educational purposes, but most of this research is specific to more traditional classroom subjects, and in more formal – and indoor – classroom settings.

Technology

The idea of technology must be examined, especially with regard to its application in an educational context. What is technology? It is interesting to turn to technology to find the answer. Princeton University has, since 1985, been building an online relational lexicon of the English language, called WordNet, which was originally an electronic version of Kučera and Francis's Standard Corpus of Present-Day Edited English. This database differs from a traditional dictionary because it uses technology to make links between and among various words and ideas. The original idea behind this project was to help to develop a more natural tool for computational language processing ("WordNet: About WordNet," 2011), and although it is a very small aspect of its full potential, using the technology of WordNet to define technology is perhaps particularly appropriate. According to WordNet, technology is defined as "applying scientific knowledge to practical problems" ("WordNet: Technology," 2006). What is interesting about this definition is that it contains no mention of devices, electronics or any other gadgets. The 'application of knowledge to a problem' might apply to any number of things, from kayaking, to using an iPod, to teaching a group of preschoolers how to identify an American robin. Clearly, technology, at its root, has a more general definition than is typically thought of today. However, for the purposes of this paper, when discussing 'technological' devices, the distinction must be made that we are considering *electronic* technological devices. Turning again to WordNet, we learn that something 'electronic' is "…relating to, or using devices that operate on principles governing the behavior of electrons" ("WordNet: Electronic," 2006). In the context of this project, this is a dissatisfying definition, for it brings to mind transistors and vacuum tubes, and does not seem to

be an accurate representation of the current, common understanding of what is electronic. Turning to a more relevant encyclopedia, the 'TechEncyclopedia,' by PC Magazine, which claims to attempt to provide clear and easily understandable definitions to popular technology terms (Freedman, 2005). They provide a definition of electronics which seems more congruent with current, popular usage: "The use of electricity in intelligence-bearing devices, such as radios, TVs, instruments, computers and telecommunications" (PC Magazine, 2011a). This definition, while similar to the previous, seems to encompass a more relevant idea of how the phrase 'electronic' is understood today. When we combine these two concepts, technology and electronic, we are simply describing a tool for the transmission of information.

An old telegraph device or a new mobile smartphone: either of these are tools to transmit information. The International Telecommunication Union (ITU), an agency of the United Nations whose aim is to "close the digital divide" (Teltscher et al., 2009, p. iii), has established the phrase 'Information and Communication Technology' (ICT) as a shorthand to describe the various mobile communication devices that have been developed over the past several decades. The ITU (which was formerly known as the International Telephone and Telegraph Consultative Committee) has, since its inception in 1865, worked to develop and propagate international standards for communication devices ("ITU History Portal," 2010). This body has also commissioned regular reports which track the increasing use of mobile communication technologies. These reports provide a large amount of interesting and potentially important data related to the adoption of communication devices. However, technological devices whose uses are not specifically related to communication are not included in the ITU's reporting. For example, an electronic device whose sole function was to play prerecorded bird calls would not

be considered by the ITU, but a smartphone with an application which can play prerecorded birdcalls would be included in the ITU's reports.

The ITU's concept of 'information and communication technology' as referring to mobile communication devices, or ICTs, is very succinct, but is an incomplete descriptor when considering educational technological devices. What is needed is a bridge between popular electronic technological devices and technological devices which are being used in educational settings.

Technology as a tool for accessing and using information is increasingly popular with college freshmen, a group of people who are at the leading edge of technological change. A 2008 study shows that although there is some level of technological disparity among incoming college freshmen, nearly all begin their baccalaureate program with a solid core set of technological skills (Kennedy, Krause, Judd, Churchward, & Gray, 2008, p. 117). Kennedy, et al, describes one particular type of educational technology, podcasts, as an increasingly popular type of technology. "A majority of students [60%] want to be able to download (podcasts) to assist with their studies" (Kennedy et al., 2008, p. 118). Lest the enthusiasm of adopting new technologies be oversold, they also note that additional research is required which will help educators better come to terms with when it is appropriate to co-opt student's 'living technologies,' those which are used by students in their personal lives, and use them in pedagogic ways, specifically, as 'learning technologies,' in their academic lives (Kennedy et al., 2008, p. 119). This is indeed an important question, as it can help inform outdoor educators when it is be appropriate to incorporate technological devices into their curriculum, and when co-opting those 'living technologies' into 'learning technologies' might be ineffective or counterproductive.

Digital Natives and Digital Immigrants

Marc Presnky has popularized the concept of digital natives and digital immigrants, as related to a person's willingness to adopt technology. A 'native' is "a person born in a particular place or country" (Princeton: Native, 2006), while an 'immigrant' is "a person who comes to a country where they were not born in order to settle there" (Princeton: Immigrant, 2006). By taking those traditional definitions and viewing them through a 'digital' lens, we can extrapolate new definitions. If a native is a 'person born into a particular place or country,' a 'digital native' is a person who was born in the land of electronic technology.' If an immigrant is a person who comes to country where they were not born in order to settle there, a 'digital immigrant' is a person who was born prior to the ubiquity of electronic technology, but who is attempting to make the journey to this new land, in order to interact with the people who were born there. Using the concept of natives and immigrants can be useful shorthand to help understand how different generations view their relationship to technology.

Digital natives are people who have been born at a time when they have always known a world with access to digital media like mobile phones, video games and the Internet (M. Prensky, 2001). Digital immigrants are people who, like their geographical immigrant counterparts, have made a conscious decision to make a journey to integrate technology into their lives. Prensky describes how digital immigrants even have digital accents – indications that 'digital' is not their first language. "There are hundreds of examples of the digital immigrant accent. They include printing out your email (or having your secretary print it out for you – an even "thicker" accent); needing to print out a document written on the computer in order to edit it (rather than just editing it on the screen); and bringing people physically into your office to see an interesting website (rather than just sending them the URL)" (M. Prensky, 2001, p. 2). These

scenarios may seem amusing, or even familiar, but Prensky warns against trivializing what they represent: "…the biggest problem facing education today is that our Digital Immigrant instructors, who speak an outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language" (M. Prensky, 2001, p. 2). In the context of this thesis, one might say that a particular challenge for today's outdoor educator is to remain relevant to today's outdoor education students; to speak the 'first language' of digital natives in a way that is accessible and understandable.

However, such a binary view of technology users – either digital (no further learning required) or immigrant (additional learning required) - may be incomplete. Stockton College's Information Technology department took Prensky's theory of digital natives and digital immigrants, and expanded and elaborated it to allow for additional nuance (Stockton College, n.d.). They developed new categories of relationships to technology, like 'Digital Recluse' or 'Digital Addict.' These and other additional categories, shown in Figure 2.1, allow for a more complex and changing relationship with technology.

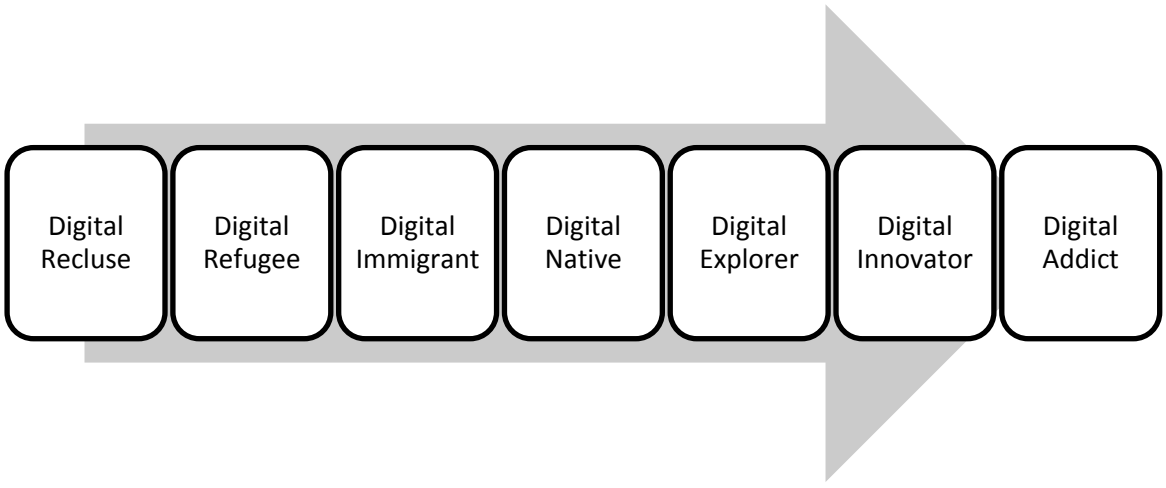


Figure 1: The Digital Continuum. This figure shows the spectrum of how people typically relate to technology.

This more complex model of how a person relates to technology is useful in a number of ways. It allows for significantly greater nuance in understanding one's relationship to technology, but perhaps more important, the Stockton Model is a continuum, and allows for movement between stages.

Over time, as new and younger employees are hired, venues providing outdoor education will be increasingly staffed by digital natives. Until this occurs, outdoor educators are most likely to be digital immigrants. Because these digital immigrants are more likely to be responsible for developing curriculum, it would behoove them to be conversant in the digital native's language. Then, the decision to use electronic technology in their curriculum will be an informed choice, and not left to chance, or turned away from because of ignorance.

Educational Technology

Various forms of technological devices have been used to deliver education for as long as people have been teaching each other. Whether using a piece of charcoal to draw on a rock, a book, a chalkboard, a smartboard or a smartphone, there have always been practical applications that have been used to help impart knowledge. A large body of research examines the use of technology in an explicitly pedagogic setting.

Cuban published a good overview of this in 1986, in "Teachers and Machines: The Classroom Use of Technology since 1920." In it, an unknown teacher from the mid-1920s wrote a poem bemoaning the 'onslaught of technology' entering the classroom:

> "Mr. Edison says
> That the radio will supplant the teacher.
> Already one may learn languages by
> means of Victrola records.
> The moving picture will visualize

> What the radio fails to get across.
> Teachers will be relegated to the backwoods…"
> "…or perhaps shown in museums.
> Education will become a matter
> Of pressing the button.
> Perhaps I can get a position at the
> switchboard" (Cuban, 1986, p. 5).

Indeed, in 1922, Thomas Edison had declared that "the motion picture would replace textbooks in schools" (Monke, 2005). Fortunately, this teacher/poet (and Edison) turned out to be wrong about teachers being relegated to the backwoods, or becoming nothing more than a museum display or a button-pusher. Cuban examined the role of education in the histories of radio, film, television and computers. He described how the various technologies were expected to change education, and how (or whether) they changed educational delivery. Cuban found examples throughout this period that showed teachers successfully integrating new technologies into their curriculum, as well as examples of new technologies failing to live up to their expectations. His ultimate conclusion was that technology does not significantly change how a teacher teaches (Cuban, 1986).

Many people have created education delivery devices over the years. Pressey and Skinner are famous for their machines created to help deliver education, Pressey's Testing Machine and Skinner's Teaching Machine. But as Skinner lamented, "Teaching machines are widely misunderstood. It is often supposed that they are simply devices which mechanize functions once served by human teachers" (Skinner, 1965). He was reacting to the rush of marketers at the time, who were hoping to sell devices which would eliminate the need for teachers. It was not Pressey's, nor Skinner's desire to supplant human teachers with machine ones. Instead, both

were looking for effective ways to measure student learning – after a teacher had delivered his or her instruction.

Some of today's electronic educational technology shares with its mechanical forebears the goal of measuring student achievement. Where current devices differ is in their ability to change their style of content delivery to suit the learning needs of the student. As will be shown later in this chapter, applications are being developed and used that are programmed to adapt to learners, independent of continuing assistance from a human teacher. Because some of these applications described below are specifically targeted to the field of outdoor education, outdoor educators should at least be aware of these technologies, and at best, know when to utilize the appropriate technology to deliver the desired outcome in a way that is most effective for each student.

Current Technology Use in Formal Education

The objective of this research is to identify which technologies outdoor educators are currently using to deliver curriculum while teaching outside. Knowing which technologies are being used indoors, in formal classroom settings, will be instructive for two reasons. First, formal education typically occurs in a controlled setting (i.e., a classroom), which provides fewer barriers to researchers than outdoor education settings. Second, so many more people have experienced traditional, formal education than have experienced non-formal outdoor education. The formal classroom can be viewed as a testbed for outdoor educators. In other words, if some technology has been shown to be effective in a formal education setting, it might also be effective in a non-formal one. Therefore, lessons learned about educational technology in a traditional classroom could be transferable to an outdoor classroom. A brief overview of the current state of formal education technology will be presented, which will lead to the more pertinent subject of technology specific to outdoor education.

People are using technology - in all its forms – more than ever. A 2010 Pew report found that 93% of adults up to age 29 own a cell phone. The report also showed that 93% of all Americans under the age of 28 spend part of every day online. When teens go online, they do it to find news about current events, to find information about diet, or to find information about sexual health topics (Lenhart et al., 2010). At the same time, the Pew Center also notes that "Internet connectivity is increasingly moving off the desktop and into the mobile and wireless environment" (Lenhart et al., 2010, p. 8).

Traditional classroom educators have adopted a number of technological devices which are currently being used to enhance teaching. Tools such as overhead projectors, SMART Boards, clickers, classroom blogs, Flickr and many others are giving educators more options to deliver their educational message than can be provided by simply lecturing in front of the classroom. However, the assumption should not be made that classroom technology (also referred to in the literature as 'instructional technology') is completely ubiquitous. Indeed, even in the formal classroom, the decision to adopt technologies such as these is left largely to individual instructors. In 2009, Hastings surveyed formal classroom teachers to discover how often they used technological devices in their instruction. She discovered that most teachers in a formal setting tend to fall on either end of the spectrum of technology use. In her survey of 280 formal educators, she found that 88% never used a portable handheld device in their teaching. Indeed, the strongest technology use by educators was not in the delivery of education, but in the use of email [86%] to communicate with colleagues. Interestingly, of those educators surveyed, 51.7% self-reported that they used "technology to present information to students" either several times per week or several times per month (Hastings, 2009, p. 90). "Overall, the descriptive

statistics indicate that most teachers more frequently use teacher-based technologies rather than student-based technologies" (Hastings, 2009, p. 92).

Part of the reason for this disconnect between the burgeoning pervasiveness of new technologies, including instructional technologies, and teachers' apparent reluctance to use these technologies for educational purposes may be because teachers don't know how to integrate new instructional technologies into existing curricula. To address this problem, new educational models that integrate established principles of educational mastery with new instructional technologies are being introduced. Salinas piloted a research study which used technological devices to teach a basic concept of psychology (stereotyping). From this study, he developed a model (Figure 2) which describes how "instructional objectives are directly linked both to the role of the instructor in the classroom and the function technology can play" (Salinas, 2008, p. 654). His model uses Bloom's taxonomy to help link various types of technology to desired outcomes. By using the correct methodology, teachers will be able to use technology in their classroom to help students meet educational objectives.

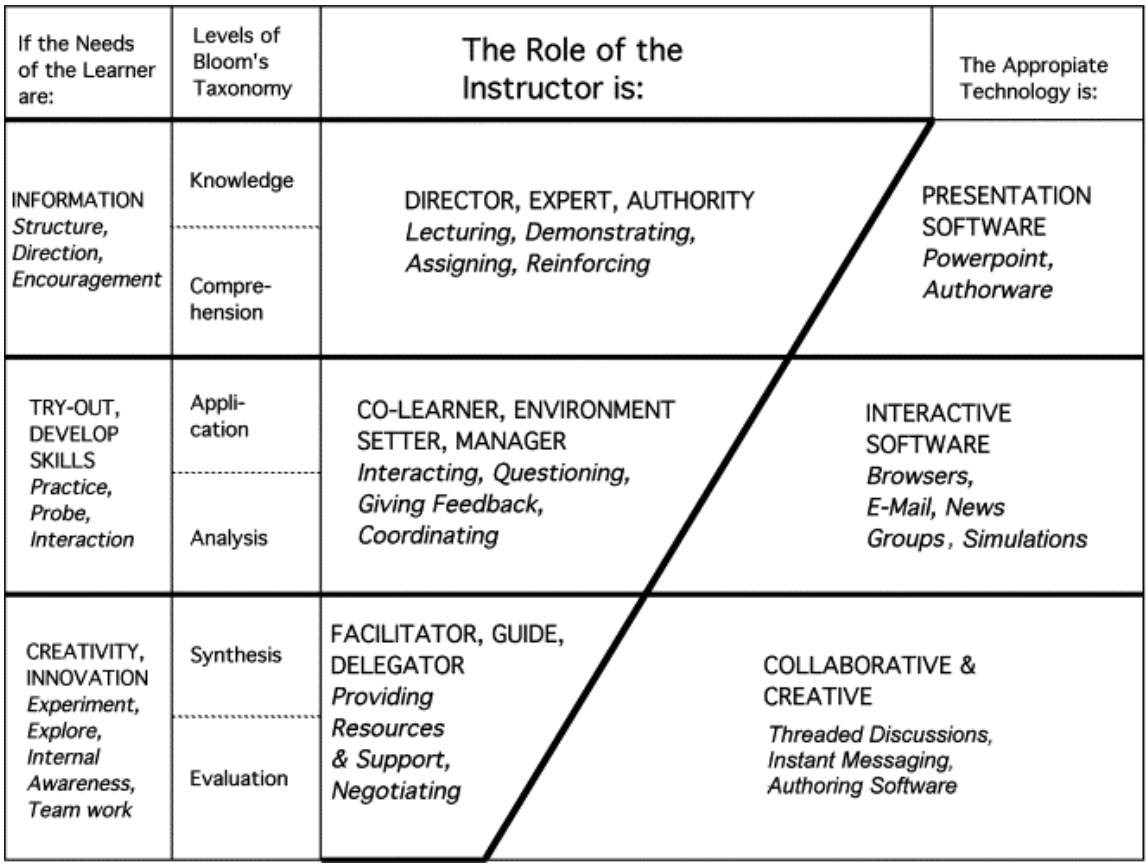


Figure 2: Salinas' Conceptual Model of Appropriate Technology Use in Classroom

However, Salinas' example shows an understandable bias toward the use of technology that is stationary: all levels of Salinas' model require the student to use a desktop computer. This makes sense, since the desktop computer is probably the device most educators used in their own pre-service training.

Desktop computers have limited application in the field due to their bulk and power requirements. In terms of relevancy for outdoor education, it is mobile devices that offer the most promise. Mobile learning platforms include GPS, phones, tablets and even touch phones. Ogata and Hui (Ogata & Hui, 2008, pp. 67–68) have identified 8 advantages of mobile learning platforms, over more traditional, static ones:

1. Permanency: Learners never lose their work unless it is purposefully deleted. In addition, all the learning processes are recorded continuously every day.

2. Accessibility: Learners have access to their documents, data, or videos from anywhere. That information is provided based on their requests. Therefore, the learning involved is self-directed.

3. Immediacy: Wherever learners are, they can get any information immediately. Thus, learners can solve problems quickly. Conversely, the learner can record the questions and look for the answers later. Generally, most educational software systems for training, learning and instruction have been developed using desktop computers.

4. Interactivity: Learners can interact with experts, teachers, or peers in the form of synchronous or asynchronous communication. Hence, the experts are more reachable and the knowledge becomes more available.

5. Situation of instructional activities: The learning could be embedded in our daily life. The problems encountered and the knowledge required are all presented in their natural and authentic forms. This helps learners notice the features of problem situations that make particular actions relevant.

6. Collaborative learning: Regardless of the physical learning scenario, mobile devices can help people learn together in an intellectual effort. The boundaries and restrictions are reduced in a collaborative learning environment, thus enhancing the overall learning process.

7. Malleability: Mobile learning gives users the opportunity to be creative and flexible. Because of the mobility characteristic, various learning systems in which creativity knows no boundary can be created.

8. Simplicity and pleasurability: More pleasure and sense of achievement is obtained in mobile learning. This is because mobile learning provides a paperless, movable and interactive learning environment. Simplicity is also the key to more effective and fun learning, because unnecessary and complicated procedures are reduced, and more time is spent on the learning itself.

These eight characteristics give the reader insight into how using mobile electronic technologies in an outdoor education setting would be a natural fit. As will be described later, handheld electronic technological devices can provide the benefits Ogata and Hui describe. However, putting all of the pieces together will not necessarily result in success. The recipe must be followed: the correct technological device must be paired with the right application, which must be used in the proper context with the prepared audience. Mobile learning platforms are a tool that should be used at the appropriate time and place.

Some Uses of Current Electronic Technology for Outdoor Education

Outdoor education has always been paired with technology. The nomenclature for both concepts may have changed over time, but the notion of 'teaching people while outside using recently created things' is not difficult to imagine. Whether teaching someone how to navigate by stars using a sextant, or teaching someone how to identify birds using a computer program installed on their mobile phone, it seems natural that outdoor educators would use the current technology of their day to help teach outdoor skills. This section will describe a number of different technologies that have been developed to help deliver outdoor education, partly to establish the validity of using these technologies as teaching aids, and also to begin to describe the wide variety of ways technological devices are currently being used by outdoor educators.

The first example should perhaps be the one that is most accessible to the largest number of people. Mobile phones, as mentioned previously, are being used by more people than ever, and at an ever increasing rate. Initially, mobile phones were designed to simply replace a traditional telephone with a device that could perform the same function, without wires. Nowadays, these small devices have become surprisingly capable computers. "Even the simplest, voice-only phones have more complex and powerful chips than the 1969 on-board computer that landed a

spaceship on the moon" (Marc Prensky, 2005). If today's phones are powerful enough to land a spaceship on the moon, it seems likely that they can also be used for aspects of outdoor education.

Unfortunately, because high quality, peer-reviewed research projects typically take several years to be published, currently available research is not keeping pace with today's fast changing technological landscape. Mobile phones have been, and are being used to help deliver education, but the technical capacities of mobile phones that are available today are significantly greater than what was available even five years ago. Because of this lag time, much of the literature that describes mobile phone use for outdoor education purposes has concentrated on personal digital assistants (PDAs), more than on mobile phones. It was in about 2005 when PDAs were peaking in popularity (Lyman, 2005). Therefore, most of the handheld devices described in the literature as being used for outdoor education are PDAs. It seems likely that, in another five years, most of the research being published will be about devices that are being widely used today.

A 2003 study used PDAs in a scaffolding model of education in conjunction with a bird watching learning system. Scaffolding is a constructivist educational model where students start with very little content knowledge, and a great deal of instructor support. As more content is learned, the instructor recedes, until the learner has become proficient in the subject content (Chen, Kao, & Sheu, 2003, p. 349). The project in this example used scaffolding to help 4th, 5th and 6th grade students learn how to identify birds. Students all received PDAs loaded with a bird watching software program. The students took a pre-test to determine baseline knowledge about the 10 birds most likely to be observed, went to a nature area to observe birds and make observations with their PDAs, and then took a post-test upon returning to their school. In the field, the student's PDAs were wirelessly linked to the instructor's PDA, and whichever student

was not answering cues correctly would receive individualized attention. The study compared students who used traditional birding field guides with students who used this scaffolded PDA method, and determined that the students using PDAs scored significantly higher on post-tests than the students who used paper field guides (Chen et al., 2003, p. 358), presumably because they had more intrinsic motivation (because of less instructor interaction) for completion throughout the teaching process.

Constructivism is inherent in mobile technologies, which offer immediate feedback and may be more effective for some learners. One study found that traditional outdoor education suffered from a lack of immediate feedback for its learners (Huang, Liu, Graf, & Lin, 2008, p. 2082). Typically in outdoor education, students receive instruction, and then head out into the field. Once there, students tend to be on their own, with the instructor moving between groups of learners. If a student is confused about something and does not receive prompt direction from the instructor, he or she may lose focus, and miss out on the lesson. The authors of this article contend that the outdoor education industry should use PDAs with Eisenkraft's 7E learning cycle for the delivery of natural science education. The 7Es are: elicit, engage, explore, explain, elaborate, extend and evaluate, and were developed by Eisenkraft from Bybee's 5E learning cycle (Huang et al., 2008, p. 2083), by adding 'elicit' and 'extend' to the original cycle. Using this expanded learning cycle as a model, and coupled with a robust electronic framework including appropriate devices and Wi-Fi Internet connectivity, outdoor educators "can overcome the weaknesses of traditional outdoor learning and make outdoor learning more effective" (Huang et al., 2008, p. 2085).

Another very common example of technology being used to help deliver outdoor education is the use of Global Positioning Systems (GPS) and Geographic Information Systems (GIS). GPS

devices are devices which record “location, velocity and time twenty-four hours a day, anywhere in the world” (Broda & Baxter, 2003, p. 158). GIS is a system which lets users “analyze and manipulate data layers. Layers could be roads, streams, population, vegetation, land use, voting patterns, pollution sites, and so forth” (Broda & Baxter, 2003, p. 158). Using GPS and GIS together allows learners to use the outside world as an integrating context for learning.

Perhaps one of the most common uses for handheld GPS devices is for geocaching, which “combines location-based gaming, social networking, treasure hunting, GPS navigation, and outdoor recreation” (Groundspeak, 2010). O’Hara describes geocaching as an activity “being used by people as a form of social recommendation about places – a way to explore and discover” (O’Hara, 2008, p. 4). Exploration and discovery seem like good first steps toward utilizing GPS for outdoor education.

An example in the literature described a framework which used GPS and several other new technologies, in a system called ‘SketchMap’ for a nature exploration class. The SketchMap system describes a single device which is made up of a tablet computer, a GPS antenna/receiver, a stylus and a USB camera/microphone. Fourth graders carried this apparatus around with them and drew a map of their surroundings with the stylus and tablet computer. With the camera/microphone, they took pictures or video, or made audio recordings. With this system, as they drew their map, the GPS device recorded their actual location. When they made audio or visual recordings of objects, those would automatically be embedded in their map, exactly where they actually were. If the children were dissatisfied with an image or sound, they could delete it and replace it immediately. This system attempts to build on the idea that “children’s experiences are augmented by articulating and recognizing the real world, and by expressing it through sketching” (Sugimoto, Ravasio, & Enjoji, 2006, p. 2).

In 2006, the International Association for Plant Taxonomy described a project in which researchers were creating an electronic field guide for field use. Starting with images from the Smithsonian's Department of Botany, photos of a number of plants were digitized. Once a large dataset was created, researchers applied an algorithm which would detect discrepancies in venation, edge details and other leaf structures, and make the entire database available to researchers in the field (Agarwal et al., 2006). Field researchers carry this dataset with them in an electronic format (on a laptop, for example), and as they came across new species, they capture an image of an unknown leaf. This image is transferred wirelessly to their computer, as well as their current GPS coordinates, date, and the name of the researcher. The algorithm compares the image just captured with best matches from the database, allowing the field researcher to make a positive identification. Although the purpose of this project is primarily field research, one can easily see how it might also be used in an educational context.

Smartphones are becoming an increasingly popular tool for delivering educational content. According to PC Magazine, "Smartphones are mobile phones that offer more advanced computing ability and connectivity than a contemporary basic mobile phone. Smartphones allow the user to install and run various applications. These advanced mobile devices possess powerful processors, abundant memory, larger multi-touch screen and a virtual keyboard with e-mail, web browsing and Wi-Fi connectivity. Today, smartphones form the fastest growing segment of the mobile phone market" (PC Magazine, 2011b). Smartphones paired with applications (programs which run on the smartphone) offer educators a large number of subject areas and delivery methods for educational content. Some of these will be described here, but new applications are being developed constantly, so this will not be an exhaustive list.

Brookfield zoo undertook a project to develop a smartphone application that was specific to their zoo. The project leaders envisioned an application which drew from precedents set from two existing applications which have been very popular, iBird and Shazam. iBird is, according to their press package, “the first of a new breed of electronic books that reinvent how we consume reference information. It has been developed to take full advantage of the rich media, high-quality graphics, and computer processing power of the iPhone and iPod touch mobile computing platforms. With a sophisticated database-driven search engine and fast access to facts, illustrations, photos, and playable bird calls, iBird Explorer puts the equivalent of over 4,000 pages of expert birding information in your pocket” (“iBird - a History,” n.d.). Indeed, iBird is, as of this writing, the third highest grossing reference application for sale through Apple’s ‘App Store’ (Apple, Inc., 2011). Shazam is an application which “uses a mobile phone's built-in microphone to gather a brief sample of music being played. An acoustic fingerprint is created based on the sample, and is compared against a central database for a match. If a match is found, information such as the artist, song title, and album are relayed back to the user” (“Shazam (service) - Wikipedia, the free encyclopedia,” 2011). The Brookfield Zoo is using these two existing applications as models to help “enhance the experience of the real world with the help of virtual tools” (Alesia et al., 2010, p. 7). This concept is one that outdoor education providers may choose to adopt.

Smartphones have many other applications that may be utilized by outdoor educators. One example is ‘Geograph MN,’ an application that can overlay Minnesota’s geologic and GIS data on a map of the state. ‘Google Earth’ is an application that uses a smartphone’s GPS to show, on a 3-dimensional map, where the user is, as well as provide GIS data, photographs of the region, and much more. ‘Pocket Universe’ is an application that utilizes the smartphone’s camera to

view the night sky and provide an overlay image of the constellations and their names. ‘Audubon Guides’ is a field guide which provide exhaustive information about birds, mammals, wildflower and trees, and includes full color photos, bird calls and animal vocalizations, as well as a diary to record sightings of these flora and fauna.

Duke University is piloting a program in which master’s students in the Duke Global Health Institute will receive iPads (touchscreen tablet computers), to conduct student field research. Using their iPads, students will “collect, organize and display data while in the field, allowing them to immediately engage in analyzing and interpreting that data when and where it has greatest meaning” (Schaffhauser, 2010).

These examples show that new technologies are being used and developed for outdoor education. Additional studies exist, and should be explored more fully to provide a richer understanding of what is happening in this area of research. With the technological landscape changing so quickly, and devices capable of so much more than might even have been conceived of a decade ago, this is sure to be a field that will be full of new and interesting research opportunities.

Advantages and Disadvantages

Problems and opportunities exist in this field. As recently as February, 2011, President Obama called for a significant increase in telecommunication funding to establish a nationwide high speed wireless network, with the goal of helping to “support basic research, experimentation and testbeds, and applied development in a number of areas, including public safety, education, energy, health, transportation, and economic development” (The White House, Office of the Press Secretary, 2011). With this initiative, the White House seems to be adopting an ‘If we build it, they will come’ mindset, which might be less gracefully rephrased as ‘if we

build a wireless information network available to almost everyone, education will be one of the positive outcomes that will be realized.' Many of the current technologies shown are most effective when they are able to connect to the Internet, so perhaps outdoor education in particular, will benefit from the president's plan.

A cautionary note was sounded by Matthew Brown, supervisor of horticulture with New York's Central Park Conservancy. Brown generally supports the idea of computerized field guides, but he doesn't think that traditional education should be left by the wayside. Brown does not necessarily think students should be required "to take botany for four years, but we [also] shouldn't lose sight of the value of learning information. If a computer can figure it all out, we can get lazy" (Eisenberg, 2009).

Summary

In conclusion, this chapter has shown that research indicates that using devices to assist in delivering education can be effective. In each specific instance, the authors show that technological devices appear to improve learning, as indicated by post-test scores. There is a good deal of research about technology use in education, and to a lesser extent, individual case studies of how technology is currently being used in outdoor education. However, there does not yet seem to be any research that takes a 'big picture' view of the issue: most research in this area deals with single populations or specific device-types. That deficiency makes this project all the more timely. Chapter three will describe the methodology used for this research, and will discuss how outdoor educators in Minnesota are currently using technological devices to help deliver curriculum.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study was to determine which technological devices outdoor educators use while teaching outside, and how often they are using them. This chapter addresses the method of research, the selection of subjects, the expected results, the conditions of actual testing and an analysis of the results.

Research Design

The design of this study was survey research. The survey was created using UM Survey, an "online survey tool centrally managed by the Office of Information Technology which is available to current students, staff, and faculty at the University of Minnesota" (University of Minnesota, 2010). The survey was delivered via email, as described below. The survey included an introduction, a statement of support from the respective presidents of the professional associations from which participant contact information was drawn, the survey, and a link for participants to review the final results of the survey. The survey was open for two weeks following email distribution. Three days prior to the close of the survey, non-respondents received a follow-up email reminder, requesting they complete the survey.

Subject Selection

This survey targeted outdoor educators in Minnesota. The population consisted of members of two professional associations of outdoor educators, the Minnesota Association for Environmental Education (MAEE) and the Minnesota Naturalists Association (MNA). The

sample consisted of all members of these organizations: 167 members of MAEE and approximately 100 members of MNA.

These two associations were selected because members of these organizations were determined to be those most likely to be in outdoor education. Additionally, using these association's membership lists made the subjects most accessible for this study.

All members of the sample frame received an email invitation to take the survey.

Outcome Measures

Outcome measures were determined through the use of an online survey. Respondents were asked about the extent they were currently using technological devices when teaching outdoors, and which technological devices they were using to deliver outdoor education. They were asked to provide information about both typical and unanticipated technology use in outdoor education.

The survey instrument consisted of 15 items. Face, content and criteria validity were pilot tested using a panel of experts. Criteria for the panel were:

1. Expertise in survey research
2. Expertise in education technology
3. Expertise in outdoor education

Reliability of the instrument was determined through IRB approval.

Conditions of Testing

After the respondents were identified, they were sent an email invitation to participate in the electronic survey. The survey was administered April 15-30, 2011, and took approximately 5-10 minutes to complete. A follow-up email was sent three days before the end of the testing period to remind non-respondents to complete the survey.

Treatments

Because this study is establishing a baseline measure of device use, no treatment was performed on respondents. This survey is intended to gather data for descriptive, not predictive, purposes.

Data Analysis

Analysis was conducted using the Statistical Package for the Social Sciences (SPSS) and will measure the following:

- Frequencies
- Measures of central tendency
- Cross-tabulations

Frequencies measured type of devices used and with what regularity they are used. Measures of central tendency helped determine the most typical uses of technology while teaching outdoors. Cross tabulation was used to create multivariate tables to examine relationships among variables.

Conclusion

Because this study is exploratory in nature and sought to assess which technological devices are currently being used, survey research was determined to be the most effective design to obtain baseline information about how technological devices are currently being used by outdoor educators while teaching outside. Subjects have been chosen from two associations in Minnesota determined to be most likely to have outdoor educators as members, the Minnesota Association for Environmental Education and the Minnesota Naturalists Association. Outcomes will be determined through the survey instrument, which will be available to the sample for a

two-week period. Data will be analyzed using SPSS and will be described in detail in chapter four.

CHAPTER 4

RESULTS

Introduction

Electronic technological devices are being used by outdoor educators for teaching while outside, but the degree to which these devices are being used is unknown. The purpose of this study was to measure the usage of these devices to establish such a baseline. This study used survey research to determine which devices outdoor educators in Minnesota were using, how often they were using electronic technology to supplement their instruction, and how those educators viewed the role of electronic technology for teaching while outdoors. This chapter reports on data collected from the survey completed by members of the Minnesota Association for Environmental Education and the Minnesota Naturalists Association.

Research Design

This survey research was conducted using an email-delivered questionnaire. Because no similar survey research on this topic was found, an instrument was created by the researcher. The questionnaire was comprised of 15 questions, and sought both quantitative and qualitative responses on questions of technology usage patterns and opinions about technological devices being used outdoors while teaching.

Subject Selection

Subjects were outdoor educators, and were primarily members of two professional associations in Minnesota, the Minnesota Association for Environmental Education (MAEE) and the Minnesota Naturalists Association (MNA). Additionally, email addresses of educators at nature centers in Minnesota were gathered using internet searches. These associations and

organizations were selected because their members were determined to be those most likely to be in an outdoor education role.

MAEE provided a list of the email addresses of their membership (n=165) and MNA required that their members (n≈100) receive an invitation to the survey via their biweekly electronic newsletter, the MNA eUpdate, instead of from the researcher directly. Some of the email addresses provided by MAEE were no longer valid, some of the members of MAEE were on sabbatical and unavailable during the survey period, and one email address had a typographical error, and was delivered to a person who was not actually a member of MAEE. This person sent a reply email to the researcher begging to be removed "from whatever mailing list he was on", and this was forwarded to MAEE. The email addresses of educators working at nature centers (n=46) were compared with the MAEE email list, and there were only two duplications. Therefore, the total sample frame was n≈309. The survey was begun by 118 people, and of those, 13 surveys were not completed. Overall, 105 complete responses out of 309 questionnaires gives a response rate of 34%.

Conditions of Testing

The survey was available for responses from April 19-28, 2011. The first invitation to the survey was emailed, and included a brief description of the survey, a link to the survey, a description of the intended audience, a consent statement, and instructions for contacting the researcher for additional information (Appendix B). The survey was active for two weeks, and a reminder to complete the survey was sent via email on April 28, 2011. These email invitations yielded a total of 105 completed responses.

Data Analysis

The quantitative data collected was analyzed using SPSS 18 and measured frequencies, measures of central tendency and cross tabulations. Qualitative responses were analyzed for both congruency to the quantitative responses and for additional context for certain responses.

All data was stored as confidential research material on a University of Minnesota password-protected network, to which only the researcher had access.

Subsequent tables and figures which display graphical representations of statistical information have been created using SPSS 18 and Microsoft Excel.

Results

The survey consisted of 15 primary questions. Six items were listed as "open," where respondents could elaborate or provide an alternative answer. Questions were presented using a variety of different formats, including multiple choice, Likert scale, array, and open text. The questions asked respondents about the primary organizations where they did most of their outdoor education, their self perception of their technological skill, how frequently they used electronic devices in their outdoor education, how frequently they perceived their coworkers using electronic devices for outdoor education, what sorts of online tools their organization used, whether they agreed or disagreed that electronic devices were a valuable tool for teaching outdoors, whether they liked experimenting with new electronic devices, what barriers they perceived to using more electronic devices for outdoor education, their personal views on using electronic devices for outdoor education, an open text box where they could share any final comments, and finally, their age.

Respondents reported that they conducted their outdoor education at a wide variety of organizations, including residential and non-residential environmental learning centers (ELCs),

city, county, state and federal agencies, zoos, K-12 schools, institutions of higher learning, and various other organizations. Some organizations which fall under the 'Other' category include county agencies, watershed districts, the MN Historical Society and an adventure travel company, among others. Table 1 presents organization type and frequency for respondents.

Table 1: Ranked Distribution of Organizations

Organization Type	Frequency	Percent
Non-Residential Environmental Learning Center	25	23.8
K-12 School	17	16.2
Residential Environmental Learning Center	15	14.3
College or University	10	9.5
City Agency (Local Park System, Municipal Nature Center, etc.)	9	8.6
State Agency (State Park, Extension Service, etc.)	7	6.7
Other	6	5.7
County Agency	6	5.7
Federal Agency (National Park Service, Forest Service, Fish & Wildlife Service, etc.)	3	2.9
Watershed Management Organization	3	2.9
Environmental Nonprofit Agency	2	1.9
Zoo	2	1.9
Total	105	100.0

This distribution indicates a satisfactory cross section of organizations being represented. Seventeen respondents chose 'Other' and described their organization in a way that was very similar to existing options. These similar responses were re-coded and grouped with the parent group. For example, the responses "Nature Center" and "Nature Center with Educational Bus" were both included with "Non-Residential Environmental Learning Center" responses.

Some of the six remaining 'Other' responses included descriptions of organizations such as "Special Park District," "Education Nonprofit Agency," and "Adventure Travel Company."

Because these responses did not lend themselves to simple reduction into one of the established groupings, they were left in the 'Other' category.

Question #2 sought to determine the respondent's self-perceived level of skill when using electronic technological devices. Most (76.19%, n=80) respondents indicated that they had an intermediate or advanced level of skill. 19% (n=20) of respondents considered their skills 'Basic,' and 4.76% (n=5) considered that they had an 'Expert' skill level, using electronic technological devices (see table 2).

Table 2: Self-Perception of Technological Skill

Perceived Skill	Frequency	Percent
Basic	20	19.0
Intermediate	44	41.9
Advanced	36	34.3
Expert	5	4.8
Total	105	100.0

The next question asked respondents how frequently they used a variety of popular devices in their teaching, when they were teaching outdoors. Device options included a smartphone (like an iPhone), a non-smartphone mobile phone, a personal audio player (like an iPod), a laptop computer, a tablet computer (like an iPad), a digital camera, a GPS device, a barcoded field guide, and 'Other.' Respondents who used devices not included on the survey choose 'Other' to describe a wide variety of other devices, some of which include trail and underwater cameras, telemetry devices, laser thermometers, three instances of a bird identification device called 'IdentiFlyer,' dissolved oxygen and pH meters, and cell phone tours (see Appendix E for complete list).

Combining all frequencies of usage, and excluding 'Never' and 'Other,' the most commonly used devices were digital cameras, and the least used devices were tablet computers. As shown in Table 3, the tablet computer is the least frequently used device-type, overall. This is not necessarily surprising, considering that these have only become popular consumer devices within the past two years.

Table 3: Respondents' Frequency of Use by Device Type

Device Type	Daily	Weekly	Monthly	< Monthly	Total
Digital Camera	17	28	28	22	95
GPS	4	11	20	32	67
Laptop	19	13	14	19	65
Mobile Phone/Smartphone	27	9	6	21	63
Audio Player	9	16	6	16	47
Barcoded Field Guide	2	4	5	8	19
Tablet Computer	3	1	0	9	13

Devices in the 'Other' category included a wide range of device-types. One respondent replied to this question: "Being a Residential Environmental Learning Center we try to keep electronics out of the classroom setting and get the kids outside experiencing nature hands on." Overall, 'Other' device-types were coded into 26 different categories, some of which are represented in Table 4, below. The full list of devices used and their frequencies can be found in Appendices E and F.

Reviewing the data for respondents' perceptions of how often their coworkers use technological devices for teaching while outdoors led to an interesting finding. It appears that respondents generally view their colleagues as more likely to use technological devices than they themselves, as shown in Table 4.

Table 4: Coworkers' Frequency of Use by Device Type

Device Type	Daily	Weekly	Monthly	< Monthly	Total
Digital Camera	16	28	22	26	92
Mobile Phone/Smartphone	24	9	10	25	78
Laptop	19	14	14	19	66
GPS	4	12	25	25	66
Audio Player	6	16	9	13	44
Barcoded Field Guide	4	7	4	10	25
Tablet Computer	3	0	6	9	18
Other: Electronic Probes	2	3	2	2	9
Other: Digital Thermometer	0	0	3	2	5
Other: Identiflyer	0	1	2	2	5
Other: Motion Sensitive Cam	1	1	2	0	4
Other: Projector	2	2	0	0	4

Digital cameras are perceived to be the most frequently used devices by coworkers of respondents, which mirrors the most frequently self-reported device used. The distribution of perceived device-use frequency by others is similar to the self-reported device-use frequency, and the approximate numbers are relatively similar until we get to the least-used devices. There, respondents seem to believe that their coworkers are using smartphones, barcoded field guides and tablet computers significantly more than respondents. This supposition is supported when one takes the total number of instances respondents claim to never have used any devices (n1=471) for teaching while outside, compared to the number of instances respondents believe their coworkers have never used devices (n2=451) for teaching while outside.

Respondents also appear to believe that they are using technological devices for teaching outside less often than their coworkers. The perception that coworkers are 'using technology' more than the respondents themselves very quickly becomes a problematic one: not everyone can be using technology less than everyone else. Whether respondents believed that they were

using more or fewer technological devices than their coworkers was not a question that was asked in the instrument.

In addition to determining the types of electronic devices of being used, the instrument also sought to answer the question of which online technologies were being used to help deliver educational content. As expected, almost every site had a website, with 98% (n=103) being kept up to date on some schedule, and 67% (n=70) being updated at least weekly (see Table 5). The next two most frequently used online content delivery methods were YouTube and Facebook. Although YouTube had a higher overall use than Facebook (75% (n=79)) for YouTube to 72% (n=76) for Facebook), YouTube tended to be updated less regularly, with new content added on a weekly or more often basis by 21% (n=22) of respondents, and 54% (n=57) of respondents updating content on a monthly or less frequent basis. Facebook updates, however, occurred only slightly less often than website updates, with 59% (n=62) of respondents updating a Facebook account weekly or more often, and 13% (n=14) providing monthly or less often updated content.

Table 5: Percentage of Online Educational Content Delivery

Online Venue	≥Weekly	≤Monthly	Any Use
Website	66.7	32.4	99.0
YouTube (or similar video sharing website)	21.0	54.3	75.2
Facebook (or similar social networking website)	59.0	13.3	72.4
Blog	25.7	15.2	41.0
Flickr (or similar photo sharing website)	10.5	21.0	31.4
Twitter	20.0	9.5	29.5
Email newsletter that is distributed regularly	0.0	21.0	21.0
Podcast	2.9	2.9	5.7
Other: Online instruction	0.0	1.9	1.9
Other: Yahoo Groups (online message board)	0.0	1.0	1.0
Other: Cell Phone Trail Stops	1.0	0.0	1.0

In Question 9, respondents were asked to what degree they agreed or disagreed with the statement: “Technological devices can be a valuable tool when teaching outdoors.” As shown in Table 6, responses indicate that 72% (n=76) of respondents either agree or strongly agree with this statement, about 9% (n=9) disagreeing or strongly disagreeing, and 19% (n=20) of respondents neutral about the statement.

Table 6: Technological Devices Can Be a Valuable Tool When Teaching Outdoors

	Frequency	Percent
Disagree	9	8.6
Neutral	20	19.05
Agree	76	72.4

Question 10 asked respondents how much they liked to experiment with new technological devices that might be used when teaching outdoors. As shown in Table 7, about 24% (n=25) of respondents like to experiment with potential new outdoor teaching devices ‘a

lot' or 'extremely.' Conversely, more respondents (34%, n=36) like to experiment 'a little,' or 'not at all.'

Table 7: How Much Do You Like to Experiment With New Technological Devices?

	Frequency	Percent
A Little	36	34.3
Neutral	44	41.9
A Lot	25	23.8
Total	105	100.0

By cross tabulating the data from Tables 6 and 7, data show that respondents who do not care to experiment with new technologies tend to be the same people who do not see the value of technology as a tool for teaching when outdoors (see Table 8). Interestingly, a small number (n=2) of respondents claim to enthusiastically experiment with technological devices that might be used while teaching outdoors, but who strongly disagree with the idea of using technological devices as a valuable tool for teaching outdoors. This contradiction does not appear to go the other direction; where respondents who strongly support the idea of using technological devices as outdoor teaching tools also do not want to experiment with using new technological devices.

Table 8: Value of Technology vs. Preference for Experimentation

How much do you like to experiment with new technological devices that you might be able to use when teaching outdoors?	Technological devices can be a valuable tool when teaching outdoors.			Total
	Agree	Neutral	Disagree	
Not at all	1	1	3	5
A Little	21	9	1	31
Somewhat	33	10	1	44
A Lot	16	0	2	18
Extremely	5	0	2	7
Total	76	20	9	105

Question 11 attempted to determine what respondents viewed as the primary barriers to greater use of technological devices during outdoor education. Respondents were asked to rate a selection of barriers, and were given the opportunity to describe their own barriers (see Table 9).

Table 9: Barriers

	Significant to Moderate	Mild	Not a Barrier	Total
Money	88	12	5	105
Time	74	24	7	105
Technical Support	62	29	14	105
Knowledge about Devices	49	40	16	105
Philosophical Objection	39	18	48	105
Other	13	1	91	105

Money was the largest significant factor (n=64), as well as the largest factor at any level of barrier (n=100). Philosophical objections were least likely to be a barrier to the use of more technological devices when teaching outdoors. In coding the responses from the 'Other' category, it became clear that some respondents could have chosen one of the assigned categories of barriers. One respondent wrote "Being too busy to remember to bring them, or plan to use them." This person could have chosen 'Time' as his or her barrier. Additionally, it

appeared that some of the philosophical objections were not necessarily the respondents'. One respondent described how the environmental education field has a cultural "perception that technology should not have a significant role in outdoor/ee," and that "a lot of time and energy is spent trying to help other staff feel comfortable with the idea of using anything beyond a digital camera." Other responses included having to deal with "Political will: struggling against 'the way things have always been done'," the wastefulness of using batteries, not feeling that peers support the value of technology in the outdoors, or dealing with websites being blocked by administration.

Question 13 asked respondents which description best matched their opinion about using technological devices for teaching outdoors (see Table 10).

Table 10: Overall Opinion about Using Technological Devices

	Frequency	Percent
Enthusiastic Adopter	13	12.4
Interested in Learning More	29	27.6
Fine with technology, fine without	51	48.6
Prefer not to use technology, but I will if needed	6	5.7
Outdoors in not the venue for electronic technology.	4	3.8
No strong opinion	2	1.9
Total	105	100.0

Most respondents (n=51) fall into a middle ground, where they will use technological devices in their outdoor lessons if it seems to be the best way to teach the lesson, but they won't go to any particular effort to work them into their outdoor lessons. A smaller majority (n=42) of respondents are either positive or enthusiastic about using technological devices while teaching

outdoors, and a small number of respondents are either slightly negative (n=6) or antagonistic (n=4) to the use of technological devices while teaching outdoors.

The last qualitative question asked "What final comments or thoughts would you like to share about using technological devices for teaching outdoors." Of the 105 respondents, 58 provided additional commentary, and 47 respondents choose to continue to the end of the survey with no additional comments. Responses were coded into nine broad categories (the complete list of responses can be found in Appendix F). In some instances, a single response provided feedback which covered multiple themes, and in those cases, the response has been divided into the different appropriately coded areas. Therefore, although 58 respondents offered additional feedback, there are more than 58 responses (n=84) shown in Table 11.

Table 11: Additional Comments: General Categories

Code	Nature of Comment	Frequency	Percent
1	Technological devices can be a good thing, but nature should be the primary focus.	21	36.2
2	Technological devices should be avoided; nature should be the primary focus.	16	27.6
3	Comment about barriers	12	20.7
4	Important to focus on impact of technology on kids	11	19.0
5	Other (variety of single-issue) responses	8	13.8
6	Use personal technology; do not use for teaching	5	8.6
7	Interested in results of this research	5	8.6
8	Used the phrase "Unplugged"	4	6.9
9	Offered book recommendation	2	3.4
	Total	84	

Representative examples from each category:

Code 1 (Respondent generally described technology as positive, but emphasized that the focus should ultimately be on nature):

- "I like the use of technology devices in environmental education where it helps to connect and enhance a student's experience in learning at our center, but not simply for the use of technology."
- "When used appropriately and because it is the best way to teach a lesson, I believe technology has a lot to bring to outdoor education."
- "It seems counterintuitive to use such devices in the outdoors, but it also seems to be a necessary evil that in order to capture interest in our teen youth, we need to engage with them on their level. As much as I hate to acknowledge that, it's a reality."

Code 2 (Respondent generally described technology as negative, and emphasized that the focus first and foremost be on nature):

- "I feel our society is flooded with technological devices and that visitors to our site benefit from time away from these devices."
- "I feel like it's this new bandwagon to jump on. We need to observe and be in real life, not attached to some device that's between us and real life."
- "Kids need to be unplugged and experience nature as it is. Not sure how technology can really enhance the outdoor experience."

Code 3 (Respondent described a variety of barriers limiting a greater use of technology):

- "I… encourage staff to use technology in their programming, but met resistance. I find that younger staff is comfortable with the idea."

- "Technology seems to be demonized, and educators won't use it for office work, let alone teaching."
- "Spending hundreds of dollars only to have a program or device become no longer compatible after 1-2 years is not a good investment of your organization's money."

Code 4 ('Other' - wide range of responses):

- Several respondents commented on issues regarding the survey's use of the word 'technology,' and found it did not encompass their ideas of the concept.
- "Lastly, the use of any tool, electronic or otherwise, should be driven by the desired outcome. The wording of this survey suggests a preconception that there is value in the use of the tool alone and not in the context of how best to use it to drive the lesson/outcome/etc."

Code 6 (Respondent uses technology for personal use, not for teaching):

- "Pre-recorded bird and frog calls are tools I use to teach myself."
- "I use the smartphone only for animal calls and field guides, but that is more for personal use than for teaching."

Code 7 (Respondents that used the word 'unplugged' in their comments):

- "Also, a nature center is one of the few places where kids can be truly 'unplugged'…"
- "Kids need to know how to unplug from the screen world and that it's actually an option!"

Code 8 (Respondent offered a book recommendation):

- "Peter Kahn has a brand new book out about this subject." [Technological Nature: Adaptation and the Future of Human Life, Kahn, 2011]

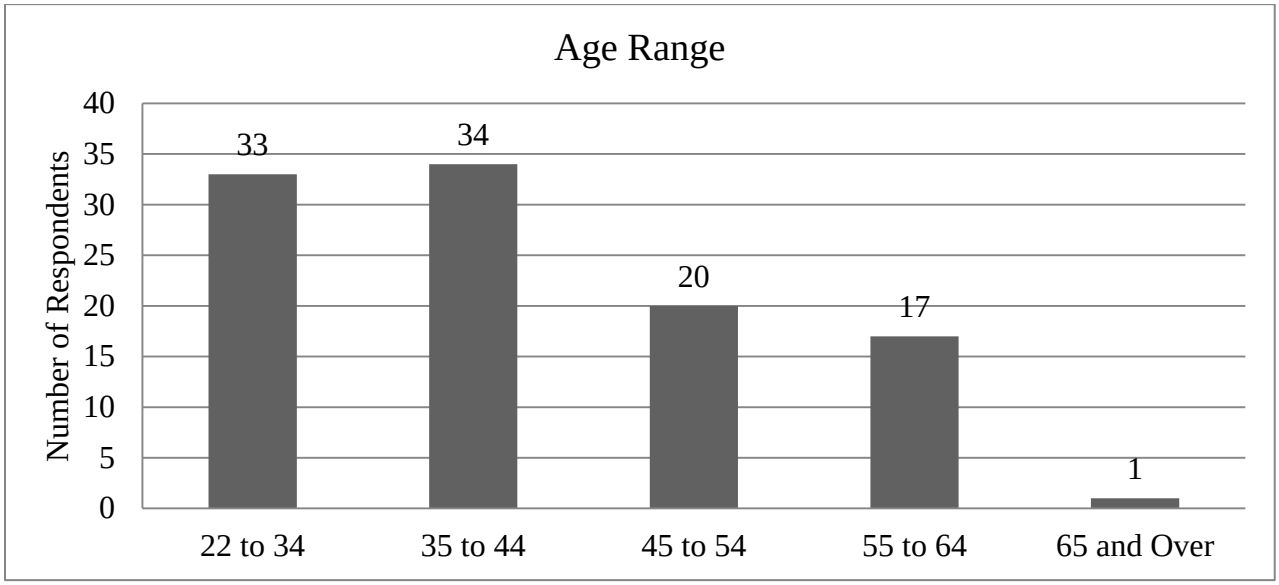
- "Read the book "Reality is Broken." [Reality is Broken: Why Games Make us Better and How They Can Change the World, McGonigal, 2011]

Code 9 (Respondent mentioned the importance of youth connecting with nature, and technology's role):

- "…I think that technological devices should be incorporated into the classroom as much as possible to give kids a leg-up."
- "It also raises the "cool" factor, breaking down barriers among audiences who don't want to be perceived in being interested in something as uncool as doing tree ID…"
- "Working with youth outdoors is to give them a break from their dependence on technology and to show them an interesting, positive learning experience without being plugged in to anything."
- "…as long as we don't lose sight of the main objective – we want students to learn about the outdoors – not just play with technology."

The final question of the survey was a demographic one: “In what year were you born?” As can be seen in Table 12, most respondents (n=67) were in the 22 to 44 years old range. Next, 44- to 54-year olds made up the next largest segment of respondents (n=20), then 55- to 64-year olds (n=17). There was one respondent in the 65 and older range, and that person was 78 years old.

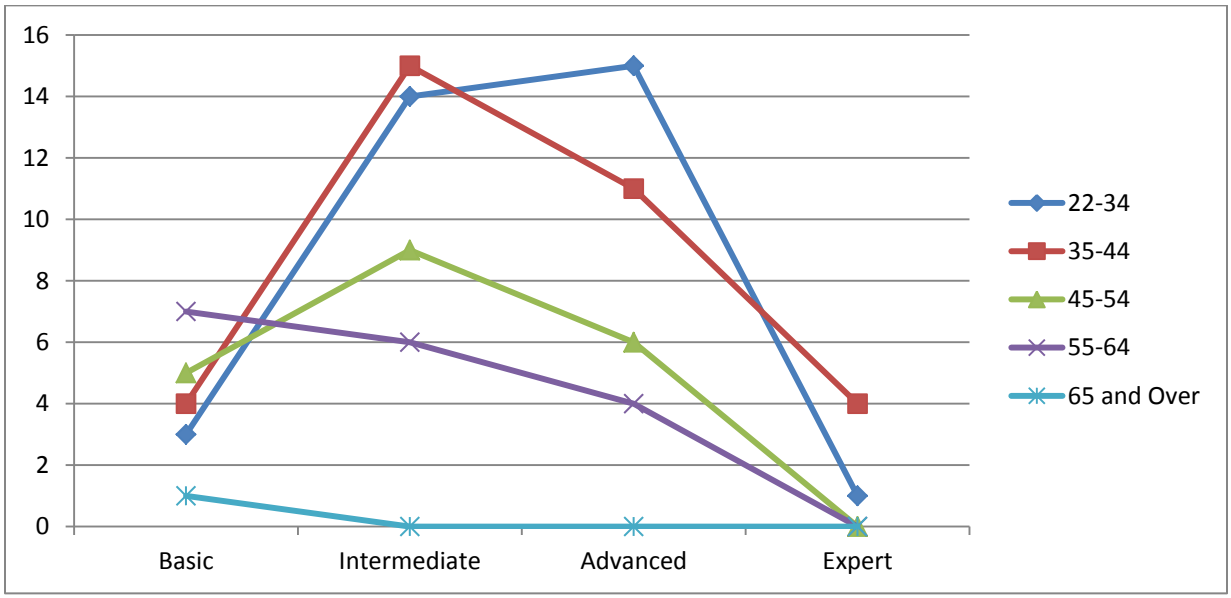
Table 12: Age Range of Respondents



There is a common presumption that younger people tend to be more willing to integrate technology into their lives and work than their older counterparts (Vaidhyanathan, 2008). Using SPSS, cross tabulation was performed to compare age with several other variables to determine whether age of respondents seemed to be a contributing factor to the use or lack of use of technological devices while teaching outdoors.

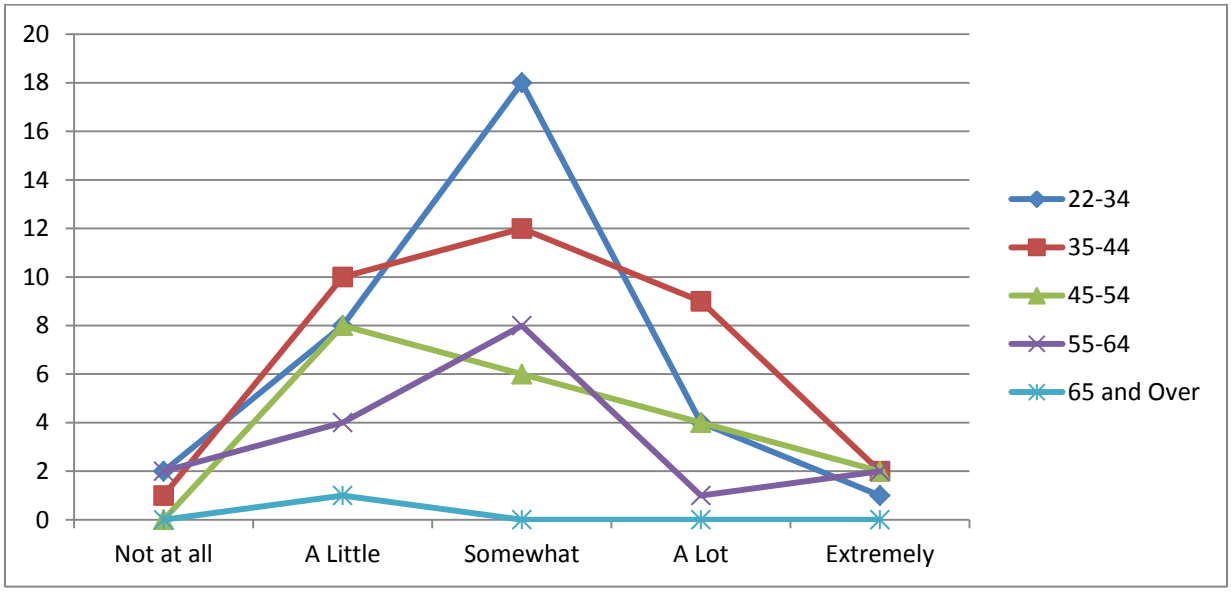
In correlating respondents' self-perception of their technological skill with their age, Table 13 shows that sense of self-efficacy when using technological devices does decrease with age.

Table 13: 'Perception of Technological Skill' vs. Age



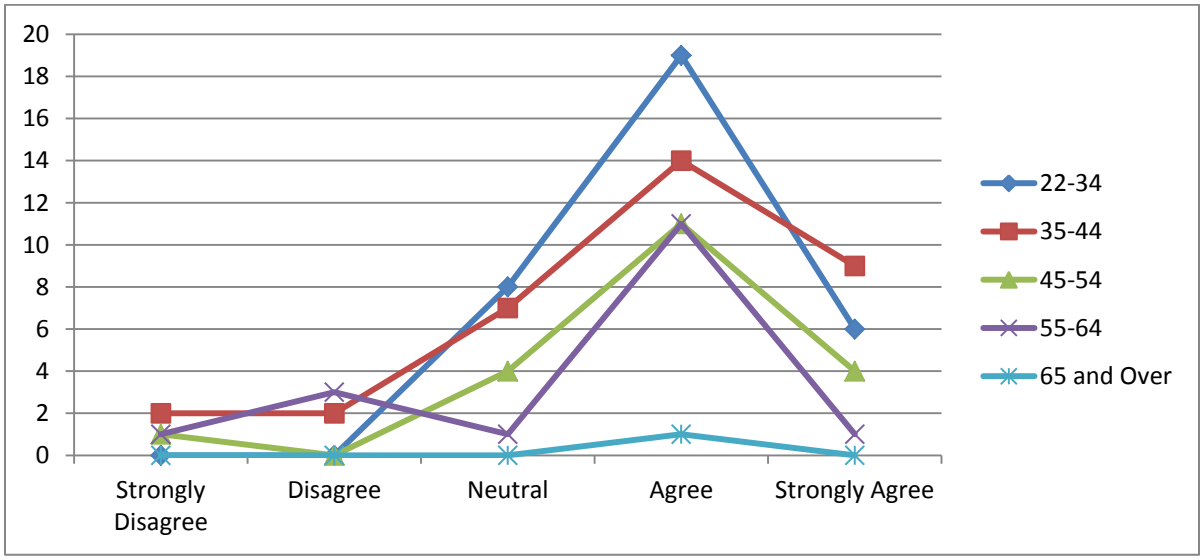
The degree to which age correlates to respondents' predilection for experimentation with new technological devices seems less clear. Table 14 suggest a bell-curve, where the interest of most age ranges tends to peak midway between the two extremes of 'Not at all' and 'Extremely.'

Table 14: ‘Like to Experiment with Technology vs. Age



Most respondents, irrespective of age, agreed that technological devices can be valuable tools when teaching outdoors, as shown in Table 15:

Table 15: ‘Technological Devices Can Be Valuable Teaching Tools’ vs. Age



What is notable about Table 15 is the low number (n=9) of respondents who disagree or strongly disagree with this premise. Also notable is that 22-34 year old respondent's strongest negative opinion about this question was neutral; none disagreed or strongly disagreed.

Conclusion

The survey results reflect the responses of 34% (n=105) of the target population. Most respondents (n=67) fell in the 22-year old to 44-year old age range, and worked in either a residential or non-residential nature center (n=40), or a K-12 school (n=17). Respondents generally agreed that technological devices could be valuable tools for teaching while outside, although they did not claim to spend a large amount of time experimenting with devices. Respondents believe that they are lagging behind their colleagues in frequency of use of technological devices for teaching while outside. They perceive that coworkers tend to use laptops, mobile phones and smartphones much more frequently than they themselves do.

Many respondents (n=58) provided additional comments in the qualitative sections of the instrument, which provided additional insight into many aspects of the survey. These open-ended responses were coded into nine broad categories, some of which were merely interesting (the number of respondents who used the word 'unplugged'), and some of which were detailed exhortations about the problems that technology represents for our culture.

Chapter Five will take a closer look at the quantitative and qualitative survey responses, and will consider those ideas in relation to themes in the literature. Chapter Five will also consider the implications of the results, offer recommendations for the use of technological devices for teaching while outdoors, and suggest avenues for future research.

CHAPTER 5

DISCUSSION

Prior to this study, it was unknown how or how frequently environmental educators in Minnesota were using electronic technological devices to aid in their teaching while outdoors. Before the survey was completed, there was a presumption that outdoor educators were not using much technology while teaching outdoors, and that there was a general discomfort with using technological devices in the outdoor education setting. The results of the study indicate that, although this stereotype describes some outdoor educators, it appears that many are attempting to stay current in our increasingly technological world by incorporating electronic devices into their teaching if they determine them to be the most effective way to reach their students. There was also an expectation that younger instructors would be much more in favor of an increased adoption of technological teaching tools than older ones. While this was generally holds true, the survey also showed that a number of younger outdoor educators are not particularly interested in using technological devices while teaching outside. There was a recurring theme in the additional comments section of the survey, of respondents stating a preference for fewer intermediary devices between nature and their students.

This study surveyed outdoor and environmental education practitioners in Minnesota. Thirty four percent (n=105) of the population responded. While these results are not necessarily generalizable to all outdoor or environmental educators, the recommendations can still be useful, by establishing a baseline for current trends of electronic technology use.

This study was intended to establish a baseline of the types of electronic technological devices outdoor educators are using to aid in instruction and to determine how those devices are being used. As described in the Literature Review, there is a large amount of research related to particular-device efficacy, such as using mobile phones to learn bird calls. However, no study was found that provided an overview of electronic technological devices being used to help deliver outdoor education. Because no research could be found that would help describe the state of affairs in the outdoor education industry, an instrument was created. Using a pre-existing instrument would have been preferred, but there did not appear to be any such instrument. However, in the 'Final Comments' section, one of the respondents wrote that he or she "…did a similar survey to this 25 years ago for masters at the U – would be interested in seeing the results!" This comment implies that a usable antecedent instrument might exist, but as mentioned in the previous chapter, since none was found, a customized one was created for this project.

Results

The respondents to this questionnaire conduct most of their outdoor education at nature centers (residential and non-residential) or schools. The majority of respondents (64%, n=67) were in the 22- to 44-year old range, and most respondents (73%, n=76) agreed that using electronic technology could be a useful tool to help deliver outdoor and environmental education. While respondents generally report using some form of electronic technology *while* teaching, they do not go to any particular effort to work these devices into their outdoor curriculum.

In terms of the establishment of a baseline, this study was successful. For example, it has been established that, in 2011, digital cameras and GPS devices are the predominant devices being used to help deliver outdoor education curriculum. To a lesser extent, laptops, iPods (or

iPod-like devices), monitoring equipment (remote temperature, turbidity, etc.) and specific-use devices ('Identiflyer' for playing birdsongs) are being used.

The survey also showed that although respondents are generally willing to use technological devices to help deliver outdoor education, many also had some misgivings about the role of technology in the profession. Many respondents made comments in the 'Additional Comments' section of the survey that described discomfort with technology in general ("Kids need to know how to unplug from the screen world…") or that showed resignation about the inevitability of using technological devices ("…it seems a necessary evil that in order to capture interest in our teen youth, we need to engage them on their level.").

Although many respondents were uncomfortable about technology in general, it was not due to ignorance: 76% of respondents felt that their skill level at using electronic technological devices was either at the intermediate or the advanced level. This indicates that respondents' reasons for not using technological devices were not a result of a lack of understanding. Most respondents (72%, n=76) agreed or strongly agreed that electronic devices could be valuable tools for delivering content while teaching outdoors. Nine percent (n=9) of respondents disagreed or strongly disagreed with this proposition.

Nearly every (98%, n=103) respondent's organization used a website to deliver content information. Electronic newsletters and Facebook were the next most frequently-used online content delivery techniques. In this regard, this survey could be particularly useful by allowing future researchers to compare the results of this survey to their contemporary results.

When it came to describing barriers to the greater adoption of electronic technological devices in helping to deliver educational content while outdoors, money was the single most Significant barrier. Money was also the largest barrier overall (adding together 'Significant,'

‘Moderate,’ and ‘Mild’ responses). Time and Technical Support were the next most Significant barriers, and the next largest barriers overall. ‘Knowledge about Devices’ was not a significant barrier, but when adding up all levels of barrier, it was very close to Technical Support. Philosophical Objections were listed as ‘Not a Barrier’ significantly more than any other potential barrier. This is interesting, especially given the number of respondents who later offered ‘Additional Comments’ which described philosophical objections to expanding the use of electronic technological devices while outdoors in nature. The reasons for this disparity are unknown, but could be due to survey fatigue or a changed perspective after completing the survey (the ‘Additional Comments’ section was at the very end of the survey).

Implications

Although results from this study are specific to outdoor and environmental educators in Minnesota, generalizations can probably be safely made for a broader outdoor and environmental education population. Also, this survey was intended to provide a snapshot; it was not meant to be an exhaustive survey of technological devices that are being used by outdoor educators.

Based on the findings of this study, outdoor and environmental educators in Minnesota are generally comfortable using some electronic technological devices to help deliver their curriculum while teaching outdoors. Although digital cameras and GPS devices are currently the most widely used devices, it seems likely that, given the rapidly growing use of mobile phones which incorporate those functions, smartphones will be increasingly used instead of digital cameras or GPS devices. Indeed, the increasing ubiquity and increasing functionality of smartphones seems to indicate that most pedagogic purposes could be met with a single device. If this occurs, then a survey on device-use may no longer be a useful instrument. Instead, outdoor

educators might need to be surveyed about which applications they are using, or which technology is the most seamless in delivering an authentic nature experience.

Overall, respondents seem to have a mixed view of the appropriate role for technology in the life of an outdoor educator. While many respondents feel that technology can be a useful tool for helping to deliver educational content, they also have misgivings about encouraging students to be any more 'plugged in' than they already are.

Recommendations

Based on the findings of this study, outdoor educators should consider the following recommendations:

- Outdoor educators should continue to stay abreast of technological tools and applications that might be used for teaching.
- Today's mobile phones typically come with GPS receivers and cameras installed. Educators should take advantage of this by creating or revising curriculum that uses these features, when appropriate.
- When available, smartphone applications (apps) should be used, primarily because their closed environment offers fewer distractions than, for example, a web browser.
- Outdoor educators should be willing to experiment with new technologies, but should keep in mind that the curriculum should drive the method of content delivery – not the other way around.

Outdoor educators will see that most of their counterparts are already using some forms of electronic technological devices in their curriculum. For an outdoor educator who is looking to start incorporating new technological devices into his or her curriculum, using digital cameras and GPS devices would probably be the easiest place to start.

This study has identified a number of specific examples of various types of devices that are currently being used by outdoor educators. These examples may prove beneficial for outdoor educators who are searching for new methods of delivering relevant content to an increasingly technologically-sophisticated audience.

This study has also provided baseline information about how outdoor education venues are using online tools like podcasts, Facebook or Twitter to help deliver information to constituents. These tools offer novel ways to teach and inform that have not previously been available to outdoor educators. For a local example of this, consider Sharon Stiteler, a National Park Service ranger in Minnesota who provides topical and phenological information through her blog (birdchick.com), via podcasts, and using Facebook and Twitter. Stiteler's use of new technologies to help deliver outdoor education content serves as an inspiration and example to other outdoor educators.

These tools are not a panacea for the problem of the diminution of the direct experience of nature, but they may help to mitigate the decline.

Future Research

This survey primarily focused on which technological tools were being used in outdoor education, primarily to establish a baseline. Now that this baseline exists, it will be important to determine *how* these tools are being used, and how effective they are. For example, given that digital cameras are the most frequently cited technological tool currently being used by outdoor educators, future researchers could explore whether digital cameras increase a connection to nature, or whether digital cameras present a technological barrier to a more complete experience of nature.

A question that was not explicitly asked, but one that most respondents seemed to be thinking about, was whether electronic technological devices are more or less effective than traditional educational methods. Do students who are learning about a particular topic learn more effectively when using these devices? Or are they able to recall information learned using such a device more readily?

It would also be interesting to compare outdoor educators perceived versus actual levels of competency at using technological devices, and to note how this affects their perceptions of the efficacy of these devices as teaching tools.

To a small extent, this survey explored the role of age as it relates to technology use. This is an area of research that will be increasingly important, considering the intersections of an increasingly aging population and an increasingly technologically sophisticated population.

This research did not take into account gender, socioeconomic status, or years in the profession of the outdoor educator. These could be potentially valuable pieces of information, and may provide insight into how and whether technological devices are used for teaching.

Lastly, a number of comments left in response to the final question of the survey described concerns about the ephemeral and fragile nature of technological devices. As these devices become more rugged and long-lasting, it will be interesting to note how outdoor educators' perceptions of these devices changes.

Summary

The combination of technology and outdoor education is an exciting area of research. Especially by outdoor and environmental educators, the appropriateness of technology in the field seems to be a highly charged topic. Technology-use opponents question whether it is appropriate to place a device between a learner and their experience. Proponents argue that, for

outdoor educators to remain relevant in an increasingly technological society, they must meet the students where they are, not where they should be. When strong opinions exist about a subject, the research opportunities can be particularly interesting and rewarding.

The findings of this study have shown that outdoor educators will use electronic technological devices if they deem them to be an appropriate tool for delivering content. However, outdoor educators, probably more so than most other educators, are wary of putting layers between learners and the natural world. Some outdoor educators feel that any technology is too much; others believe that whatever tool that helps develop an awareness and appreciation of nature is an appropriate one to use.

In the end, outdoor education will not succeed or fail on the basis of which tools – electronic or otherwise - are used to help convey information to learners. These tools are merely methods that outdoor educators have at their disposal to help kindle and encourage an appreciation for and knowledge about the natural world.

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APPENDICES

APPENDIX A: LETTERS OF ENDORSEMENT

Minnesota Association for Environmental Education
3815 American Boulevard East
Bloomington, MN 55425
http://naaee.org/maee

March 26, 2011

Dear Mr. French:

I understand that you are conducting a survey to determine how outdoor and environmental educators use technology when they are teaching outdoors. I also understand that you wish to access the staff in my association as respondents for your study.

I support your study and will provide you access to member emails. I also understand that their responses will be anonymous and that you will not be able to use the information from your study to either identify my agency nor our members.

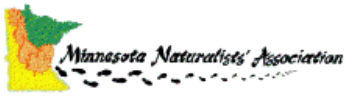
The Minnesota Association for Environmental Education (MAEE) is a 501(c)3 non-profit organization with a mission of supporting and advancing environmental education in Minnesota. Our membership consists of over 150+ classroom teachers and non-formal educators.

I wish you well on this study!

Sincerely,

Britt Gangeness

Britt Gangeness, board president
Minnesota Association for Environmental Education
Britt.Gangeness@gmail.com
651-253-9324 (cell)



Minnesota Naturalists' Association
PO Box 75127
St. Paul, MN 55175

April 7, 2011

Dear Mr. French,

I understand that you are conducting a survey to determine how outdoor educators are using technological devices when they are teaching outdoors. I also understand that you wish to access the membership of the Minnesota Naturalists' Association (MNA) to invite them to participate in your survey.

The MNA Board of Directors supports your study and will provide access to our members for the purpose of this research. We understand that survey is entirely anonymous and voluntary, and has no link to current or future relationships with the University of Minnesota, or with our association.

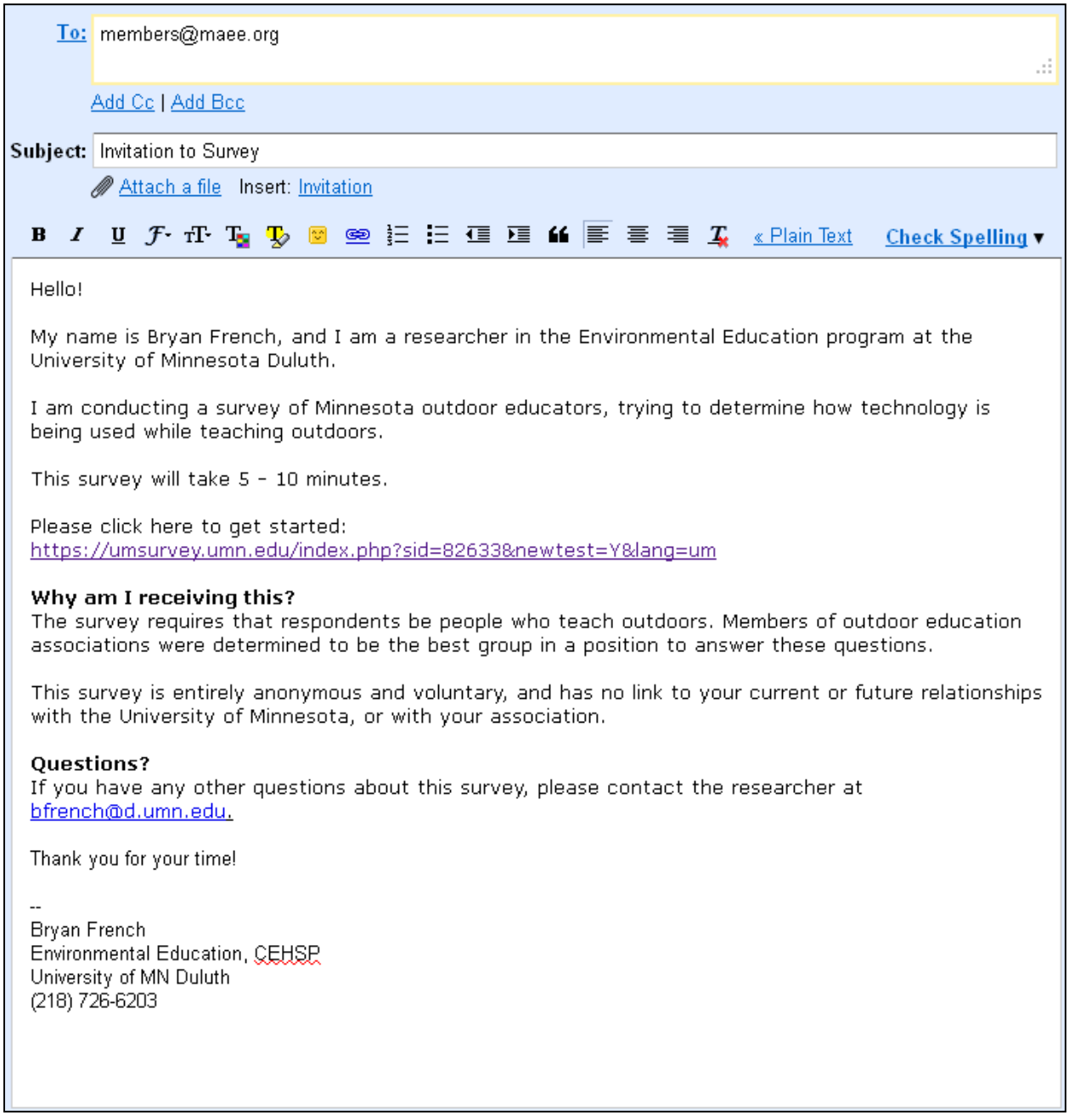
The Minnesota Naturalists' Association exists to advance natural and cultural resource interpretation for the purpose of fostering wise stewardship of all resources. MNA offers its members growth opportunities in skill and career development and serves as a forum for interpreters to pool knowledge, share ideas, and establish contacts with colleagues. The use of technology in outdoor and environmental education is a relevant and interesting topic to our field and many members, so the survey fits well with advancing MNA's mission and goals. MNA currently has 100 active formal and non-formal educator members and an additional list of inactive members that will receive your request through our email update. I will send you the final number of inactive members on our list from our information committee chair next week. Please contact me if you have any additional questions.

Good luck on your research!

Sincerely,

April Rust, President
Minnesota Naturalists' Association
april.rust@state.mn.us / 651.259.5706

APPENDIX B: INVITATION TO SURVEY



To: members@maee.org

Add Cc | Add Bcc

Subject: Invitation to Survey

Attach a file Insert: Invitation

« Plain Text Check Spelling ▾

Hello!

My name is Bryan French, and I am a researcher in the Environmental Education program at the University of Minnesota Duluth.

I am conducting a survey of Minnesota outdoor educators, trying to determine how technology is being used while teaching outdoors.

This survey will take 5 - 10 minutes.

Please click here to get started:
https://umsurvey.umn.edu/index.php?sid=82633&newtest=Y&lang=um

Why am I receiving this?
The survey requires that respondents be people who teach outdoors. Members of outdoor education associations were determined to be the best group in a position to answer these questions.

This survey is entirely anonymous and voluntary, and has no link to your current or future relationships with the University of Minnesota, or with your association.

Questions?
If you have any other questions about this survey, please contact the researcher at bfrench@d.umn.edu.

Thank you for your time!

--
Bryan French
Environmental Education, CEHSP
University of MN Duluth
(218) 726-6203

APPENDIX C: CONSENT INFORMATION

UNIVERSITY OF MINNESOTA
Driven to Discover℠

Technology Use by Outdoor Educators

The purpose of this survey is to discover which electronic technological devices outdoor educators in Minnesota are using, while teaching outdoors.

This survey will take 5 - 10 minutes to complete.

Please complete this survey before April 30, 2011.

Thank you for your time!

Who is asking?
This survey was developed by Bryan French, a researcher in the Environmental Education program at the University of Minnesota Duluth.

Why am I receiving this?
This survey requires that respondents be people who teach outdoors. Members of outdoor education associations were determined to be the best group in a position to answer these questions.

This survey is entirely anonymous and voluntary, and has no link to your current or future relationships with the University of Minnesota, or with your association.

Questions?
If you have any other questions about this survey, please contact the researcher at bfrench@d.umn.edu.

A note on privacy

This survey is anonymous.

The record kept of your survey responses does not contain any identifying information about you unless a specific question in the survey has asked for this. If you have responded to a survey that used an identifying token to allow you to access the survey, you can rest assured that the identifying token is not kept with your responses. It is managed in a separate database, and will only be updated to indicate that you have (or haven't) completed this survey. There is no way of matching identification tokens with survey responses in this survey.

APPENDIX D: SURVEY

Technology Use by Outdoor Educators

The purpose of this survey is to discover which electronic technological devices outdoor educators in Minnesota are using, while teaching outdoors.

This survey will take 5 - 10 minutes to complete.

Please complete this survey before April 30, 2011.

Thank you for your time!

There are 16 questions in this survey

All Questions

1 How would you describe the organization where you do most of your outdoor education? *

Please choose **only one** of the following:

- ○ Residential Environmental Learning Center
- ○ Non-Residential Environmental Learning Center
- ○ Zoo
- ○ Aquarium
- ○ City Agency (Local Park System, Municipal Nature Center, etc.)
- ○ State Agency (State Park, Extension Service, etc.)
- ○ Federal Agency (National Park Service, Forest Service, Fish & Wildlife Service, etc.)
- ○ K-12 School
- ○ College or University
- ○ Other

2
How you would rate your skill level, when it comes to using electronic technological devices in the workplace?

[This question is intended to determine how competent you feel, when it comes to using technological devices in general]
*

Please choose **only one** of the following:

- ○ None
- ○ Basic
- ○ Intermediate
- ○ Advanced
- ○ Expert

3 How often do <u>YOU</u> use the following devices in your teaching, when you are teaching outdoors?

[Choose one frequency per row. You <u>must choose</u> some option for "Other." If "Other" does not apply, select "Never used"]
*

Please choose the appropriate response for each item:

	Never used	Daily	Weekly	Monthly	Less than once a month
Smartphone (like an iPhone)	○	○	○	○	○
Mobile Phone (not a Smartphone)	○	○	○	○	○
Personal Audio Player (like an iPod)	○	○	○	○	○
Laptop Computer	○	○	○	○	○
Tablet Computer (like an iPad)	○	○	○	○	○
Digital Camera	○	○	○	○	○
GPS Device	○	○	○	○	○
Field Guide/Barcode Reader	○	○	○	○	○
Other	○	○	○	○	○

4 If you chose 'Other' for the previous question, please describe what electronic devices you use when teaching outdoors:

[Only answer this question if you answered 'Monthly' or 'Laptop Computer' or 'Less than once a month' or 'Tablet Computer (like an iPad)' or 'Weekly' or 'Personal Audio Player (like an iPod)' or 'Daily' or 'Smartphone (like an iPhone)' to question 'Frequency Self]

Please write your answer here:

5 If you had to generalize about the rest of the teaching staff at your organization, how often do you think they use the following devices, when teaching outdoors?

[For this question, you will need to generalize the tendencies of the rest of your organization's entire teaching staff for a single answer.

Choose one frequency per row. You must choose some option for "Other." If "Other" does not apply, select "Never used"]
*

Please choose the appropriate response for each item:

	Never used	Daily	Weekly	Monthly	Less than once a month
Smartphone (like an iPhone)	○	○	○	○	○
Mobile Phone (not a Smartphone)	○	○	○	○	○
Personal audio player (like an iPod)	○	○	○	○	○
Laptop Computer	○	○	○	○	○
Tablet Computer (like an iPad)	○	○	○	○	○
Digital Camera	○	○	○	○	○
GPS Device	○	○	○	○	○
Field Guide/Barcode Reader	○	○	○	○	○
Other	○	○	○	○	○

6 If you chose 'Other' in the previous question, please describe what electronic devices you see others use while teaching outdoors:

[Only answer this question if you answered 'Weekly' or 'Personal audio player (like an iPod)' or 'Monthly' or 'Laptop Computer' or 'Less than once a month' or 'Tablet Computer (like an iPad)' or 'Daily' or 'Smartphone (like an iPhone)' to question 'Frequency Others]

Please write your answer here:

7 Which of the following tools have ever been used at your organization? *

Please choose **all** that apply:

- [ ] Website
- [ ] Blog
- [ ] Facebook (or similar social networking website)
- [ ] Flickr (or similar photo sharing website)
- [ ] Youtube (or similar video sharing website)
- [ ] Email newsletter that is distributed regularly
- [ ] Twitter
- [ ] Podcast

Other:

8 Considering the same tools from the previous question, how often are these tools updated and kept current? *

Please choose the appropriate response for each item:

	Never used	Daily	Weekly	Monthly	Less than once a month
Website	○	○	○	○	○
Blog	○	○	○	○	○
Facebook (or similar social networking website)	○	○	○	○	○
Flickr (or similar photo sharing website)	○	○	○	○	○
Email newsletter	○	○	○	○	○
Podcast	○	○	○	○	○
Twitter	○	○	○	○	○
Other	○	○	○	○	○

If your site does not use one of these tools, please choose "Never used" for that row.

9 In your opinion, technological devices can be a valuable tool when teaching outdoors. *

Please choose **only one** of the following:

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

10 How much do you like to experiment with new technological devices that you might be able to use when teaching outdoors? *

Please choose **only one** of the following:

- ○ Not at all
- ○ A Little
- ○ Somewhat
- ○ A Lot
- ○ Extremely

11 To what degree are the following factors a barrier to your using MORE technological devices when teaching outdoors? *

Please choose the appropriate response for each item:

	Significant Barrier	Moderate Barrier	Mild Barrier	Not a barrier
Not enough money	○	○	○	○
Not enough time	○	○	○	○
Not enough technical support	○	○	○	○
Not enough knowledge about devices in general	○	○	○	○
Philosophical objection to using technological devices for outdoor education	○	○	○	○
Other	○	○	○	○

12 If you chose 'Other' in the previous question, what barriers are preventing you from using more technological devices in your outdoor curriculum?

[If this question does not apply, please leave blank]

[Only answer this question if you answered ' Significant Barrier' or 'Not enough money' or 'Mild Barrier' or 'Not enough technical support' or 'Moderate Barrier' or 'Not enough time' to question 'Barriers to Tech Use]

Please write your answer here:

13 Which statement best describes your opinion about using technological devices for teaching outdoors? *

Please choose **only one** of the following:

○ I enthusiastically adopt new technological devices and am usually the first person at my organization to work them into my outdoor lessons.

○ I am interested in hearing about ways I might be able to use new technological devices in my outdoor lessons.

○ I will use new technological devices in my outdoor lessons if it seems the best way to teach the lesson.

Otherwise, I don't go to any particular effort to work them into my outdoor lessons.

- ○ I would prefer to not use new technological devices in my outdoor lessons, but will do so if required.
- ○ I don't think outdoor education is an appropriate venue for technological devices.
- ○ I haven't given it much thought, or I don't have a strong opinion.

14 Do you have any final comments or thoughts about using technological devices for teaching outdoors?

Please write your answer here:

15 In what year were you born?

[The purpose of this question is to correlate trends of technology use related to age] *

Please choose **only one** of the following:

- ○ 1900
- ○ 1901
- ○ 1902
- ○ 1903
- ○ 1904
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- ○ 1987
- ○ 1988
- ○ 1989
- ○ 1990

- ○ 1991
- ○ 1992
- ○ 1993
- ○ 1994

16 Thank you for your time!

If you would like to receive a copy of the results, send an email to the researcher at bfrench@d.umn.edu.

Please submit by 2011-04-30
Submit your survey.
Thank you for completing this survey.

APPENDIX E: FULL SURVEY RESPONSES FOR QUESTION 4

4. “If you chose 'Other' for the previous question, please describe what electronic devices you use when teaching outdoors:”

- Dissolved Oxygen Meter (H2O)
- Digital monitoring devices (pH, DO, etc.), digital projectors, slide projectors.
- Portable lab equip.
- Tracking devices
- Radio telemetry receiver
- Thermometers, bat detector, laser pointer in evening sky (iPhone only used as a timepiece)
- Digital thermometers, Infrared thermometers, Water chemistry sonde with datalogger, Radio telemetry equipment, Underwater/ice viewing cameras, Digital wildlife survey cameras
- Compass, ruler, magnifying lenses--who says that technology must include a battery?
- Flip Camera
- Motion sensitive camera
- Video camera with real time footage to portable monitor
- Being a Residential Environmental Learning Center we try to keep electronics out of the classroom setting and get the kids outside experiencing nature hands on. We will sometimes use powerpoints in our classes (using computer and projector) to cover some background information but in our three hour classes this portion is only about a half hour.
- Underwater camera/scope trail camera digital thermometer, Identiflyer
- Laser thermometers and projector/screen with a laptop.
- GIS software for mapping data
- Digital thermometer
- Digital thermometers
- LabQuest data collection technology and probes
- Cell Phone Tours
- IdentiFlyer
- Promethean Board or "Smart" Board, LCD projector, laser pointer, radio telemetry equipment, LabQuest units with many different probes, online programs like podcasts and bird cams. Motion sensor cameras, time lapse cameras, weather station with live feed to building.
- Compound microscopes
- Digital pH and DO meters.
- Portable speaker system.
- Sensors
- Identiflier video camera
- Identiflyer Sky Scout
- Identiflyer (for bird calls)
- Probeware
- Satellite phone, flip video camera

APPENDIX F: CODING AND FREQUENCIES FOR RESPONSES TO QUESTION 4

4. “If you chose 'Other' for the previous question, please describe what electronic devices you use when teaching outdoors:”

	Daily	Weekly	Monthly	Less than once a month	Total
Electronic Probe System	2	3	2	2	9
Digital Thermometer	0	0	3	2	5
IdentiFlyer	0	1	2	2	5
Motion Sensitive Camera	1	1	2	0	4
Projector (Digital)	2	2	0	0	4
Radio Telemetry Equipment	0	0	2	1	3
Video Camera	0	1	0	2	3
Laser Pointer	1	0	0	1	2
Underwater Camera	0	0	2	0	2
Bat Detector	0	0	0	1	1
Birdcam	1	0	0	0	1
Cell Phone Tours	1	0	0	0	1
Compound Microscope	0	0	0	1	1
GIS software for mapping data	0	0	1	0	1
Infrared Thermometer	0	0	1	0	1
Laptop	1	0	0	0	1
Laser thermometer	1	0	0	0	1
Podcasts	1	0	0	0	1
Portable speaker system	0	1	0	0	1
Satellite phone	0	0	0	1	1
Sky Scout	0	0	0	1	1
SMART Board	1	0	0	0	1
Time Lapse Camera	1	0	0	0	1
Video camera with real time footage to portable monitor	1	0	0	0	1
Water Chemistry Sonde with Datalogger	0	0	1	0	1
Weather Station with Live Feed	1	0	0	0	1
Total	15	9	16	14	54

APPENDIX G: SURVEY RESPONSES FOR QUESTION 14

The following are the verbatim responses, in order of received, from the question: “What final comments or thoughts would you like to share about using technological devices for teaching outdoors?”

1. Peter Kahn has a brand new book out about this subject.

2. Pre-recorded bird and frog calls are tools I use to teach myself.

3. Technology is neither good nor "evil." However, my general inclination is to avoid placing technology layers between our students and direct experience with nature. I would hope that our visitors are impressed with the natural world vs. impressed with the latest tech gizmo.

4. The technology incorporated need to be meaningful - not just technology for technology's sake. Read the book "Reality is Broken."

5. I like the use of technology devices in environmental education where it helps to connect and enhance a student's experience in learning at our center, but not simply for the use of technology, e.g. the use of an ipod for song and photo of the bird for whom we are searching. Also, I value that demonstrating technology common to what a student may see in their future, e.g. use of digital pH meters.

6. It works great!

7. If I could use an app to instantly identify something I am seeing, that would be helpful. At this point, I don't plan to pursue that. Kids need to be unplugged and experience nature as it is. Not sure how technology can really enhance the outdoor experience.

8. Although technology seems counterintuitive to outdoor education, I feel it a necessary tool to better the experiences of delivering ideas, content and broadening background information for my students.

9. Money, especially now, tends to be a huge barrier. Also, a nature center is one of the few places where kids can be truly 'unplugged', so unless they are doing a STEM-related class or unit, I think it's a good idea to keep things as simple as possible. Though I'm not a classroom teacher, I think that technological devices should be incorporated into the classroom as much as possible to give kids a leg-up.

10. They are a valuable tool and cahn link a generation to the outdoors via digital media, it is a safe interface for kids to interact anc continue the learning beyond the day inthe field.

11. My answers reflect that I am teaching outdoors about 15-20 days/ year right now. I am in a management position and encourage staff to use technology in their programming - but met Resistance. I think age (and thus exposure) is a consideration. I find that younger staff is comfortable with the idea.

12. I find that I do use some of these devices for my classes - indoors. I answered your questions strictly regarding the word "outdoors."

13. Interested to find out the results of this study!

14. When used appropriately and because it is the best way to teach a lesson, I believe technology has a lot to bring to outdoor education. Technology simply for technology's sake is unnecessary and can lead to more distractions.

15. Nice job, Bryan. I think this survey works well.

16. Flint and steel is a technological device, yet there is no survey pondering its use outside. Might be a good idea to achieve some common point about technology or use a more specific term. New snowshoes are a technology, so are kevlar canoes, clipboards with write-on laminate, and so on. Seems the survey is premised on an unstated, yet suspected bias regarding "technology". facebook is technology, but email is not. a desktop is not technology, but a laptop is. Hmmm...seems like an implied, shared understanding of what is and is not considered technology. Good luck.

17. Technological devices are useful when enhancing understanding, but should not become the focus or be a distraction from the intended goal.

18. Using the devices is a "gateway" to audiences who are used to using the devices. Once outdoors, I work to wean people off technology and use their god-given skills. Technology is a tool and sometimes a "lure" to getting people outside. It also raises the "cool" factor, breaking down barriers among audiences who don't want to be perceived in being interested in something as uncool as doing tree ID or something like that.

19. To me " electronic technological devices means", trail cameras, lasers, spotting scopes, microscopes, thermometers, pH probes, telescopes, oxygen sensors, sonars, underwater cameras, solar panels, projecting magnifiers.

20. If we want to protect the outdoors, we should not promote a culture of resource waste and pollution like that that comes along with the purchase of non-recyclable, non-transparent, electronics. If we have I-Phones in the classroom, how much does that encourage a student to go purchase one? How much does it enable the wrong direction of travel - one that is unsustainable? The devices used in class should be as environmentally sound as our mission is. From their cradle to their grave. The means of meeting our mission must align with the ends we hope for. I would say lastly that you should only use electronics in the classroom if you know how they were manufactured (as green as possible? unlikely)

educate on how they will be used (energy wasters? maybe) and how they will eventually be disposed (recyclable? dream on).

21. Expensive, then out of date soon!

22. I think an even bigger barrier than cost may be appropriate applications for such things as ipads. There are lots of things we COULD do with technology but the applications people are writing are not usually geared toward our work. Those who work in this field tend to also be not well versed in technology which leads to less adoption of tech or worse, fear or distrust of technology. Not specifically mentioned but used by people in my field are motion activated cameras, remote web cams, laser and IR thermometers, digital personal weather stations such as the Kestrel, smart boards, walkie talkies, and game trail cameras. I would even include the use of color copiers to create professional looking teaching materials.

23. I think that technology can be useful in teaching outdoor education when it is an appropriate method of engaging your audience and aids in connecting them to the natural world.

24. I truly believe that technology devices can be used in an office setting to boost knowledge and marketing for on environmental education center, however as a teaching technique in outdoor education it should play a very limited to non-existent role. I believe as outdoor educators we need to teach and encourage hands on learning and experiencing the world in an un-pluged way.

25. To reach the generation that is used to technology, I think Outdoor Education has to implement everyday technology for students to engage. Once they engage, the outdoor venue is opened to them and I truly believe they will connect with it. It is the bait.

26. I feel our society is flooded with technological devices and that visitors to our site benefit from time away from these devices.

27. I think I use technological devices (mainly my computer and the internet) for researching and lesson planning the most. It is helpful for students to gain experience with technology, but it has been more helpful in my own preparations than using the devices in programs.

28. using appropriate tools is important, as long as we don't lose sight of the main objective- we want students to learn about the outdoors- not just play with technology.

29. did a similar survey to this 25 years ago for masters at the U - would be interested in seeing the results!

30. This survey didn't address the use of using technology WHILE teaching about the outdoors. We frequently use technology when teaching a lesson and then go outside to

see it applied (but without using technology, more hands on-at this point, tecnhnology seems to be a barrier between getting students to see the outdoors around them).

31. I feel like it's this new bandwagon to jump on. We need to observe and be in real life, not attached to some device that's between us and real life.

32. It seems unnecessary most of the time.

33. I think technological devices can enhance an outdoor learning experience and perhaps allow kids to feel more comfortable with learning outdoors if we use things they are already familiar with.

34. I think the use of technology really depends on the type of activity. If we are doing something that involves data collection, it makes sense to use technology to measure and record information. But we're trying to reconnect people with the natural world and to do that, they need to turn off their electronic devices so they can hear and see what's actually out there and not just an image or soundbite.

35. I consider it more important to know how to navigate by map & compass than to know how to use a GPS. I appreciate using a digital altimeter, especially in high-altitude environments. Since I like to travel lightly, and my naturalist skills are low, the most useful technology for me would be a means to carry a field guide(s) w/o having internet access, on a very small device! that would be super cool.

36. Technology seems to be demonized and those that are educators won't use it for office work let alone teaching.

37. They can be useful at times, such as imitating animal sounds. I think it is usually easier and more effective to teach with the natural surroundings instead. Use teachable moments.

38. It is OK to use technology at appropriate times and places, but do practice well before the presentation. Be prepared to make an alternative presentation if the technology fails or other difficulties arise.

39. I think efforts to do more relaxation exercises, breathing/meditation exercises, more observation techniques, more hands-on. Kids need to know how to unplug from the screen world and that it's actually an option!

40. Portable devices can augment the lesson, but don't let them become the lesson. Nothing can beat direct contact with nature.

41. I am concerned when technology introductions in Outdoor and Environmental Education actually increase passive screen time--I don't believe that they necessarily do this, but some methods do.

42. I do not feel that this survey was able to characterize the types of outdoor education that we do, which is impt bc I think we fall into a different category than most. Also the uses of the devices was limited and the types of devices were not well defined - seems that communication media were emphasized and should be distinguished from data collection devices - such as GPS, probes, hydrolabs, remote wireless monitoring, etc. Lastly the use of any tool, electronic or otherwise, should be driven by the desired outcome. The wording of this survey suggests a preconception that there is value in the use of the tool alone and not in the context of how best to use it to drive the lesson/outcome etc.

43. It seems counter-intuitive to use such devices in the outdoors, but it also seems to be a necessary evil that in order to capture interest in our teen youth, we need to engage with them on their level. As much as I hate to acknowledge that, it's a reality. Hopefully through that engagement, we'll be able to help them appreciate the outdoors without reliance on electronic devices.

44. If they will enhance the instruction and add to the outdoor experience with minimal time factoring, I would like to consider their use.

45. The outdoors is an area like all other areas in teaching that learning how to use technology is not a choice. We need to learn how to use it effectively to enhance learning in the outdoors.

46. Devices are expensive and when they break or get stolen it becomes a problem.

47. Depends on the age of the audience, and the objective of the lesson. For me an objective of working with youth outdoors is to give them a break from their dependence on technology and to show them an interesting, positive learning experience without being plugged in to anything.

48. students need to see the other site of nature. They are tuned in way too much to their i-stuff. In class and out with me, I try to get them to realize there is another side of life

49. We have seen how GPS units are effective in getting new audiences into our parks. It can be overwhelming as techology changes to find the best and most effective way to achieve our goals and then be able to train staff to use these tools and have the tools available.

50. Another factor in not investing in technology is how fast they become rendered useless. Spending hundreds of dollars only to have a program or device become no longer compatable after 1-2 years is not a good investment of your organization's money.

51. Most of these seem impratical for outdoor use. I use the smartphone only for animal calls and field guides, but that is more for personal use than teaching.

52. I think technological devices are a signigicant way to engage youth in outdoor learning and help prepare them with 21st century skills. I also think, however, it is important to balance outdoor learning time with unplugged, full sensory experiences.

53. These are good questions to ask. There is not enough time or money to even have the conversations with colleagues in environmental education to discuss ways to enhance existing programs with technology, and successes and roadblocks that staff who have tried using technology outdoors.

54. I have experienced using GPS & cameras with all ages (young as 2 years old) & limited physical disablities on GEO cache style progams. Learning more about cameras & lap tops

55. Have found using a video microscope and monitor a wonderful teaching tool. Materials are found outside and brought inside where the devices are used.

56. Other than GPS, digital cameras and maybe an electronic field guide for someone who already owns a smart phone I can't think of many uses for electronic tech in outdoor EE. I'm more about experiencing nature firsthand and unencumbered. The tech might be more useful after the fact back inside. I'm open to suggestions though - especially if there is a grant involved!

57. i think the over-use of some gadgets undermines the value of certain kinds of experiences and skills (ie. GPS vs. map and compass)

58. I'm always open to new technology, but money, time and support are huge obstacles.